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Determinants of the demand for home mortgage debt in Canada and the United States (CMHC)

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DETERMINANTS OF THE DEMAND FOR HOME MORTGAGE DEBT IN CANADA AND THE UNITED STATES

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The project proposal indicated an intention to base primary data reliance on the 1984 Canadian Survey of Consumer Finances and the 1987 U.S. Survey of the same name. Mr. Myette suggested that it is important for comparison purposes to use data bases collected at points closer together in time. In response we relied primarily on the 1983 U.S. Survey of Consumer Finances and the 1984 Canadian SCF; the interviews for these surveys were conducted within a year of each other. In Chapter V of this study we use additional Canadian and U.S. data bases, both of which were collected in 1986.

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ABSTRACT

DETERMINANTS OF THE DEMAND FOR HOME MORTGAGE DEBT IN CANADA AND THE UNITED STATES

The Study analyzes the determinants of the demand for home mortgage debt in Canada and the United States. It does so by formulating a model which allows debt demand to be decomposed into that portion derived from the demand for owner-occupied housing and a residual component interpretable as deriving from the demand for nonhousing assets. From this model the incidence and magnitude of households' demand for home mortgage debt to finance nonhousing assets is determinable.

The Study finds that, contrary to conventional assumptions, Canadians do use home mortgage debt for nonhousing purposes as frequently as Americans and that the magnitude of this "excess" debt, as a share of total mortgage debt, is not much less than in the United States. In addition, it appears that his "excess" debt is systematically linked to investments in high risk illiquid assets, such as closely held businesses and investment real estate. This finding applies in both the U.S. and Canadian contexts but more strongly for the Canadian case. This finding, together with estimates of the impact of nonhousing wealth, and tastes for financial assets, on mortgage demand, constitutes evidence refuting prior studies that conclude the principal motivation for mortgage financing of nonhousing assets is to create diversified portfolios.

Use of mortgage debt to finance nonhousing activities is, in general, likely to be optimum only if the interest payments on this debt are deductible for purposes of calculating taxable income. The usual assumption in the

Canadian tax context is that the transaction costs required to continuously maintain the separation of mortgage debt into its housing and nonhousing components are prohibitive. However, the Study finds that when an estimated marginal income tax rate is included as a proxy for the household specific after tax cost of debt, it makes a significant contribution to explaining debt demand.

RÉSUMÉ

VARIABLES EXPLICATIVES DE LA DEMANDE DE CRÉDIT HYPOTHÉCAIRE À DES FINS RÉSIDENTIELLES AU CANADA ET AUX ÉTATS-UNIS

Cette étude se veut une analyse des variables explicatives de la demande de crédit hypothécaire à des fins résidentielles au Canada et aux États-Unis. Elle propose donc un modèle qui permet de décomposer la demande de crédit pour cerner d'une part, la composante dérivée de la demande de logement pour propriétaire-occupant et d'autre part, la composante résiduelle qui peut être interprétée comme dérivée de la demande de biens non résidentiels. À partir de ce modèle, on peut déterminer l'incidence et l'importance de la demande de crédit hypothécaire faite par les ménages pour financer des biens non résidentiels.

Dans cette étude, on constate que, contrairement à ce que l'on pense habituellement, les Canadiens font usage du crédit hypothécaire pour financer des biens non résidentiels aussi souvent que les Américains, et que cette dette «excédentaire», comme partie de la dette hypothécaire totale, est presque aussi élevée au Canada qu'aux États-Unis. De plus, il semble que cette dette «excédentaire» soit systématiquement reliée à des placements dans des valeurs non liquides à risques élevés, comme des entreprises à capital fermé et des placements immobiliers. Même si cette constatation s'applique au Canada comme aux États-Unis, elle reflète davantage une réalité canadienne. Ainsi, cette constatation et l'incidence que peut avoir sur la demande de crédit hypothécaire la possession de biens non résidentiels et d'avoirs financiers, permettent de réfuter clairement les études antérieures qui arrivaient à la conclusion que la principale raison motivant le financement

des biens non résidentiels au moyen de crédit hypothécaire, était de créer des portefeuilles diversifiés.

En général, le recours au crédit hypothécaire pour financer des activités non résidentielles n'est vraiment valable que lorsque les versements d'intérêt reliés à cette dette sont déductibles aux fins de calcul du revenu imposable. Dans le contexte fiscal canadien, on a tendance à penser que le coût des transactions nécessaires pour assurer la répartition constante de la dette hypothécaire entre sa composante résidentielle et sa composante non résidentielle, est prohibitif. Or, notre étude constate que lorsque l'on inclut dans le modèle prévisionnel un indicateur estimatif du taux marginal d'impôt, pour le coût après impôt de la dette attribuable au ménage, il est alors beaucoup plus aisé d'expliquer la demande de crédit.

INTRODUCTION

This study focuses upon the determinants of the demand for home mortgage debt in Canada and the U.S. Despite the extraordinarily large mortgage activity in these countries, no systematic studies of household loan demand exist.

The monograph is organized as follows. Chapter I reviews the issues central to such an analysis and the treatment of the determinants of mortgage activity found in the literature. Our interest and approach derive from an earlier (CMHC funded) attempt by the author to estimate the demand for mortgage debt (Jones 1984). This estimation took place in the context of an analysis of current wealth effects upon housing tenure and housing demand. From a critique of this earlier approach we conclude that understanding the demand for mortgage debt in a portfolio choice context requires a credible method of distinguishing the portion of demand derived from the demand for housing from the component derived from the demand for nonhousing assets.

In Chapter II we formulate a model capable of identifying these two components of mortgage demand. The model also permits us to identify situations in which the housing asset is partially financed by nonmortgage debt. We achieve these distinctions by modelling a certain world in which housing demand is endogenized and optimal mortgage demand is solely driven by the demand for housing. The model is extended to identify optimal mortgage debt positions under costless recontracting during an extended housing tenure.

We label the deviations of observed mortgage debt positions from the model's optimum as 'excess demand.' This 'excess' may be positive or negative. We then utilize the Asset and Debt microdata tape from Statistics Canada's 1984 Survey of Consumer Finance to estimate the

quantity of home mortgage debt used to finance nonhousing assets and the amount of nonmortgage debt used to finance housing. We speculate on why households would desire more mortgage debt than required to finance their home, given the (apparent) nondeductibility of home mortgage interest payments in income tax computations. We also speculate on why households would use costly nonmortgage debt to finance their owner-occupied housing asset.

Chapter III is devoted to econometric estimation of the excess demand for debt. The empirical specification follows from portfolio choice principles in a world where market imperfections typically produce incomplete household portfolios. We assume homeowning households make portfolio elections having predetermined housing demand and the optimal mortgage debt required to finance the selected housing asset. Nonhousing assets are financed from the model's definition of net worth not committed to housing equity, if any, and by mortgage and nonmortgage debt. Willingness to incur debt is viewed as a function of the strength of asset demands and the degree of household risk aversion to leverage.

Total debt and mortgage debt demand is estimated initially in a set of reduced form equations. Subsequently, household tastes for specific asset classes and household wealth are endogenized. Since, as noted, household portfolios are usually incomplete, we use estimation methods that allow for the possibility of selection bias.

In Chapter IV we apply the model to U.S. data by using the 1983 U.S. Survey of Consumer Finances. This allows for reasonably credible comparisons with the Canadian results since the Surveys are similar in structure and were conducted close to the same period in time. We repeat the allocation estimates obtained in Chapter II and the econometric estimations of Chapter III on U.S. data. Of particular interest are differences in the magnitudes of 'excess' mortgage demand and a comparison of the factors determining excess demand. We are also able

to test the significance of subjective information on risk aversion, and of data relating to permanent wealth, which are not provided in the Canadian Survey.

In Chapter V we explore for additional insights by examining data on household adjustments in mortgage debt positions. This is accomplished with the U.S. data by merging observations from the 1983 Survey into the 1986 Survey for 1983 households reinterviewed in 1986. In a more limited fashion, we use the 1986 Statistics Canada Family Expenditure Survey, which we were able to augment by contracting with Statistics Canada to add data dealing with mortgage loans to the public micro data file.

A brief summary of the study's conclusions and their implications is provided in Chapter VI.

CHAPTER I

THE DEMAND FOR HOME MORTGAGE DEBT

Home mortgage loans represent one of the major sources of demand placed upon Canadian and U.S. capital markets. For example, in both countries net issues of home mortgage loans typically exceed, by a sizable margin, the net debt financing of corporations.[1] There exists a very extensive theoretical and empirical literature dealing with the determinants of corporate capital structure and the demand for corporate debt financing. However, in his recent review of the mortgage loan literature Follain (1990) is only able to cite a single study that estimates the determinants of the demand for home mortgage debt using micro household data.

The single citation of Follain's is an article by this author (Jones, 1986) which derived from a monograph dealing primarily with housing demand prepared by the author under a CMHC External Research Program grant (Jones, 1984). The approach we shall undertake in the current study derives from a critique of the earlier undertaking. We motivate this approach by briefly reviewing the role of mortgage debt in housing demand models in Section A and in portfolio choice model in Section B.

In Section C we review the Jones (1984, 1986) approach and provide an estimated mortgage demand regression in the spirit of Jones (1986) using the more recent 1984 Survey of Consumer Finance micro data base. Finally in Section D we critique the Jones (1986) results and use this critique to conclude that successful understanding of mortgage debt demand requires explicit modelling of the debt demand derived from the demand for housing.

A. The Determinants of Mortgage Loan Positions in the Housing Demand Literature

The lack of attention to issues of mortgage demand appears to be attributable to two views embedded in the macro housing demand literature. First, Guttentag (1961) and Alberts (1962) postulated mortgage markets in which stable demand schedules interact with supply schedules, expressed as a function of interest rates, that are highly sensitive to shift variables. Thus, changes in loan activity are viewed as supply driven. This underlying presumption has continued to be present in the expanding credit rationing literature.

The second characterization of mortgage demand present in the housing demand literature is the presumed strong linkage of mortgage and housing demands. This linkage is forged in both directions by assumptions that i) owner occupiers are debt dependent; i.e. debt is typically required for owners to be able to own desired levels of housing stock, ii) there exist no cost effective alternatives to home mortgage debt for this purpose and iii) home mortgage debt is used solely to finance owner-occupied housing assets. Thus, in the context of disequilibrium mortgage credit rationing, the linkage hypothesis implies that excess demand for mortgage credit is matched by an excess demand for owner-occupied housing.

The supply orientation and linkage hypothesis come together dramatically in Jaffee and Rosen's (1979, p. 354) assertion that

> "On the demand side most borrowers find mortgage credit necessary to finance their home purchases and they seek the largest loan available based upon their collateral."

Similar statements are found in Hendershott and Lemmon (1975) and Rothenberg (1983), among others. Underlying this debt maximization hypothesis is the assumption that the after tax cost of mortgage debt is less than both the cost of equity funds and the cost of nonmortgage debt.

The latter assumption regarding rate spreads is questionable in the U.S. context and particularly doubtful in the Canadian tax environment. An alternative assumption is used by Ranney (1981) in her model of housing prices and returns to homeownership in an inflationary environment. Ranney assumes that the after tax cost of mortgage debt always exceeds the after tax cost of equity. Then, so long as the cost of mortgage debt is lower than the cost of alternative debt, the linkage hypothesis is maintained but households are now optimally mortgage debt minimizers rather than mortgage debt maximizers.

The linkage hypothesis has also come under criticism. In particular, objections to the linkage hypothesis have been lodged by Arcelus and Meltzer (1973), Meltzer (1974) and de Rosa (1978). These authors emphasize the fungibility of the various components of household balance sheets. Using U.S. Flows of Funds data to estimate a Brainard-Tobin (1968) portfolio adjustment model, de Rosa finds evidence that changes in home mortgage debt positions are responsive to adjustments in nonhousing assets and that housing demand is not limited by mortgage credit constraints. On the other hand, using the same macro data source, Hendershott and Hsieh (1980) do not find evidence that changes in aggregate mortgage demand are affected by the demand for nonhousing assets.

B. Contributions of the Portfolio Choice Literature

If the critics of the linkage hypothesis are correct, then a natural approach to the analysis of the demand for mortgage debt is to adopt the principles of portfolio choice theory. This theory depicts households as choosing the time path of consumption to maximize lifetime utility subject to lifetime wealth. With the inclusion of assumptions restricting asset price paths and trading costs, lifetime utility maximization is consistent with investors choosing their current

portfolio as if they were optimizing over the mean and variance of the portfolio, subject to a budget constraint that restricts the sum of asset demands to the sum of household net worth and amounts borrowed. Maximization yields a set of first order conditions from which demand equations for each asset (liability) are determinable.

Realistic adoption of this approach to explaining asset (debt) demands must recognize the empirical reality that household portfolios are typically incomplete; Blume and Friend (1975) and King and Leape (1984) have provided evidence on the small number of available assets typically held by U.S. households. This study finds a similar pattern for both U.S. and Canadian households. Explanations of this phenomenon include high transaction costs (Goldsmith, 1976), asset management costs (King and Leape, 1984), constraints on short sales (Auerbach and King, 1983) and tax clientele effects (Feldstein, 1976).[1]

In addition to these possibilities, however, is the apparent strong taste for home ownership in North America and the radical impact of home ownership upon portfolio mix. Homeownership matters because housing units are such extraordinarily lumpy, indivisible assets. Using the 1977 Statistics Canada Survey of Consumer Finances micro database, Jones (1986) shows that for younger (under age 40) urban homeowners, their home represents three-quarters of their assets; this ratio remains above sixty percent for the older cohorts. Similarly, mortgage debt accounts for about 85 percent of the liabilities of younger homeowners and this ratio declines only marginally as households age. Given the dominance of a single asset and liability in homeowner portfolios, it is not surprising that transactions and management costs, non-negativity constraints and tax effects act to limit the number of additional asset (debt) classes held by homeowners.

Of course, ultimately the amount of nonhousing assets held by homeowners is constrained by the degree of household risk aversion toward borrowing as well as by lender imposed constraints on debt accumulation. A central purpose of the current study is to identify the determinants of homeowners' willingness to use home mortgage debt to finance nonhousing assets.

Given the prevalence of incomplete portfolios, estimation of asset demand equations should use econometric methods that allow for the sample selection bias that may be present when only the subsample of non-zero holders of an asset are included in the estimation. King and Leape (1984) employ the two stage 'Heckit' procedure to estimate reduced form conditional demand equations for eleven asset classes, including home mortgages. We shall use the Tobit procedure to deal with the selection bias issue.

C. Estimation of a Mortgage Demand Equation

Jones (1988) follows portfolio choice principles in estimating a reduced form mortgage demand function. The equation estimated is of the form

(1) M/H = M(NW, EARN, PD, A, Z)

where M = outstanding home mortgage debt

NW = current net worth

EARN = current earnings from human capital

PD = personal debt outstanding

A = a vector of nonhousing asset positions

Z = a vector of household attributes

The specification is similar to specifications found in systems of asset (debt) demand equations (King and Leape, 1984). It assumes the loan ratio is driven by nonhousing asset (and consumption) demands. The principal hypothesis is that the mean-variance optimization requires some portfolio diversification to reduce the exposure of household portfolios dominated by the single asset, owner occupied housing. If household wealth (NW) is limited, this diversification must be financed by borrowing. Assuming mortgage debt is the most cost effective form of borrowing for owner households, a strongly significant negative sign on NW provides support for this hypothesis.[2]

Households' willingness to incur debt may also be constrained by the cash flow available to cover debt service obligations. Current labor earnings (EARN) are utilized to proxy household cash flows. A positive sign is expected on EARN. Household nonmortgage debt positions (PD) are included to allow for the possibility that for some households the greater flexibility of personal and consumer debt make these forms of borrowing effective substitutes for mortgage debt in meeting portfolio objectives. The variable PD is measured as a proportion of nonhousing assets (total assets less the market value of the home).

The vector A is included to provide further confirmation of the diversification motive and to allow for strong household tastes for specific types of assets, particularly tastes generated by factors other than diversification benefits. To further test the diversification motive we assume that households would elect financial assets to provide diversification benefits to a portfolio containing an owner-occupied home. We use the share of household assets in stocks, bonds, mutual funds and other securities (FIN) to proxy this objective.

Other asset tastes may be linked to entrepreneurial or professional skills possessed by household members. Thus, self-employed professionals may have professional assets in their

portfolios and households operating businesses may have significant business asset positions. Similarly, persons possessing property management skills may choose to include investment real estate in their household portfolios. Home mortgage debt may be a cost efficient means of financing these positions. Following Jones (1986), we include in the estimations below the proportion of nonhousing assets represented by business and professional assets (BUS) and real estate assets (REAL), other than the home, as representations of A.

Finally, the Z vector attributes serve as an indirect way of proxying households' aversion to debt. We assume that highly educated households (EDUC) and those in professional or managerial occupations (OCCUP) will have more stable earnings and be more disposed to accept leverage risk. However, we suppose risk aversion increases with age (DHAGE) and number of dependents (CHILD).

The estimation is performed on the subsample of owner occupiers used in the econometric results reported in Chapter III below. This subsample is restricted to young (heads and spouses, if present, under age 40) urban spending units constituting a single economic family unit. The family unit constraint effectively ensures the observed actors are households. We require households to have an employed head to be included in the sample. Other restrictions are imposed to ensure households conform to those in the model formulated in Chapter II, to eliminate credit rationed borrowers in order to ensure we observe demand choices, and to ensure certain variables used in Chapter III are calculable. The rationale for each sample restriction is provided in Chapters II and III.

The dependent variable used in Jones (1986) is the loan-to-value ratio represented in cross section data as the ratio of the mortgage balance outstanding to the estimated market value of the house (MTH). This variable is effectively censored between zero and unity. Since a

significant number of sample households hold zero mortgage debt, but may prefer negative positions, we estimate demand equations throughout this monograph by employing the Tobit censored normal regression model. We deal with the censoring from above by defining the dependent variable to be MMTH = MTH/(1-MTH); MMTH is not censored from above so long as the full value of the collateral is available to the borrower selecting a desired loan ratio.

The estimations reported in Jones (1986) were performed on the 1977 Statistics Canada Survey of Current Finances micro database. The result reported in Table I-1 was estimated on the micro database produced from the 1984 Survey. Several non-linear specifications were estimated but the basic linear version produced the greatest explanatory value.

The results are generally consistent with expectations. Both NW and EARN have the hypothesized signs and are highly significant. However, FIN is insignificant and with the wrong sign to support the interpretation that the strong negative effect of wealth reflects a diversification motive. On the other hand, tastes for illiquid business and real estate assets have positive impacts on mortgage demand. On the basis of the insignificant coefficient on PD, the demand for mortgage debt appears unrelated to the demand for personal and consumer debt. The strong significance of DHAGE suggests that risk aversion to leverage increases with age (within the under age 40 sample), and, to a lesser extent, children have the same effect. The sign on EDUC is the opposite of our expectation.

D. A Critique of the Estimation Approach: Implications for this Study

The estimation approach reported above is consistent with mortgage demand equations estimated in empirical applications of portfolio choice, such as King and Leape (1984). However, it is open to criticism on several fronts.

Table I-1
Tobit Estimation Result
for the Mortgage Debt Ratio
Dependent: MMTH

NW	-.005 (10.1)
EARN	.011 (4.16)
PD	.029 (0.78)
REAL	.404 (1.92)
BUS	.989 (4.41)
FIN	-.023 (0.05)
EDUC	-.147 (1.66)
OCCUP	.094 (1.05)
DHAGE	-.043 (4.41)
CHILD	-.066 (1.77)
CONSTANT	1.55
Log Likelihood	-1026
R^2	.269
No. Obs.	771

Notes: MMTH, NW, EARN, PD, REAL, BUS and FIN are defined in the text. NW and EARN are measured in thousands of dollars. EDUC takes on the values of unity if the head (or spouse, if present) have a degree, diploma or certificate from a post-secondary institution, and is zero otherwise. OCCUP takes on the value unity if the head (or spouse) is employed in a professional or managerial position, and is zero otherwise. CHILD is the number of children under 16 residing in the household and DHAGE is the age of the Household Head-18. Asymptotic 't' statistics are reported in the ( ).

First, this specification is not able to distinguish among housing demand, nonhousing asset demand and nonhousing consumption demands for debt financing. Thus, the wealth, income, asset vector and household attribute effects are difficult to interpret with confidence. It appears that an adequate explanation of debt demand requires a conceptually credible method of identifying the optimal amount of mortgage debt to use in acquiring (and maintaining) the owner-occupied home. Conventional measures of the debt and equity components of housing finance are based on ex post observations; a measure of the ex ante optimal debt is required.

Second, in the Canadian tax environment, non-deductibility of home mortgage interest arguably means that most households face an after tax cost of debt higher than the cost of equity. If Canadian households respond by using as little debt as possible, then for a given desired housing asset, desired debt will be inversely related to net worth. Thus, the insignificance of FIN in the Table I-1 result may indicate that the strongly significant negative sign on NW reflects a debt minimization objective rather than a diversification motive. Testing for this difference in interpretation also requires an ability to conceptually distinguish housing-driven mortgage demand from debt desired to finance nonhousing assets.

Third, asset (debt) demand equations, like that in Table I-1, are reduced form estimations. They assume that all explanatory valuables are exogenous or predetermined. However, household wealth, earnings and asset tastes are likely to be functions of a variety of household attributes. To be confident about estimated coefficients and their interpretations, asset tastes and wealth, in particular, arguably should be endogenized in the estimation process.

We respond to this critique by formulating a model in Chapter II that is designed to determine the optimal amount of mortgage borrowing desired from the demand for owner-occupied housing. Identifying this amount will allow us to identify the amount of mortgage debt

desired to finance nonhousing asset demands. The econometric work that follows will focus on explaining this 'excess' demand for home mortgage debt. In these econometric estimates we shall attempt to endogenize household wealth and nonhousing asset 'tastes.'

Footnotes to Chapter I

[1] For example, during the past four years (1987-90) net borrowing by U.S. corporations in all forms averaged $141 billion U.S. per annum while net borrowing via home mortgage loans averaged U.S. $225 billion. During the same period in Canada, net borrowing by non-financial businesses averaged $17.7 billion Cdn. versus a $26.4 billion Cdn. net increase in home mortgage loans. The U.S. estimates are computed from the Federal Reserve Bulletin, June 1991, Table 1.57, p.A40 and the Canadian data from "Credit Market Developments in 1990," Bank of Canada Review, May 1991, Table I, p.5 and Table II, p.6.

[2] Jones (1990) has shown that current net worth is an especially important component of household permanent wealth in determining owner housing demand in Canada. The expected negative sign on NW presumes, however, that the elasticity of housing demand with respect to NW is significantly less than unity. This presumption is confirmed by the finding that the NW elasticity is in the range .3 to .5 (Jones, 1990).

CHAPTER II

MODELLING THE OPTIMAL DEMAND FOR MORTGAGE DEBT DERIVED FROM HOUSING DEMAND

The goal of this chapter is to formulate a model in which households optimize home mortgage debt under assumptions that ensure mortgage demand is solely derived from housing demand. The purpose of such a model is to permit empirical decomposition of observable debt positions into the portion financing the principal residence and the component derived from the demand for other assets. The magnitude of the latter component provides a test of the credibility of the mortgage debt-housing demand linkage hypothesis.

We build upon the life cycle housing demand model proposed by Ranney (1981). In Section A we adapt the Ranney model to focus upon the determination of optimal mortgage debt when it is chosen simultaneously with an endogenously determined demand for housing. We show for our model how either the debt maximization or debt minimization result is derivable conditional upon the relative cost of mortgage debt. In Section B we extend the model to permit continuous recontracting of the mortgage loan during the tenure in the chosen housing unit. We identify the assumptions that produce debt minimization as the optimal choice throughout the housing tenure.

In Section C we consider how market imperfections and uncertainties may produce mortgage debt decisions that either fall short of or exceed the certainty model's debt 'minimization' optimum. We adapt the debt minimization objective to an uncertain environment

in Section D and utilize the model to measure the incidence and magnitudes of debt shortfalls and excesses utilizing Canadian household survey data. Positive excess debt amounts are interpretable as home mortgage debt financing of assets other than the principal residence. Negative excess debt quantities are interpretable as the amount of personal (nonmortgage) debt used to finance the owner occupied unit. We conclude with a brief summary of the paper's conclusions and their implications in Section E.

A. Modelling the Linkage Between Housing and Mortgage Demands At the Time of Home Purchase

Our task is to provide a conceptual basis for identifying the quantity of mortgage debt that derives directly from the quantity of owner-occupied housing demanded. To accomplish this objective, we use a model developed by Ranney (1981) in which both demands are simultaneously determined at the time of home purchase in a life cycle framework. We adapt Ranney's model by modifying the attributes of home mortgage loans available; initially the most important alteration is to eliminate downpayment constraints imposed by lenders. Thus, mortgage borrowings are purely demand determined. In this Section we derive the optimal housing-driven mortgage debt position at the point of home purchase. Section B extends this result to determine optimal mortgage stock demand at any point of time during home ownership.

Households in Ranney's model are life cycle utility maximizers residing in a certain world. The relevant life cycle runs from $t=O$, when the household initially purchases a home, to $t=T$, when household members retire from the labor force and the house acquired at $t=O$ is sold. These decision points are given exogenously, but the size of house (H) acquired is endogenous. The asset H produces housing services (h) at a constant flow rate (ϕ); thus $h=\phi H$.

The housing asset is purchased initially at a certain unit price (P_{HO}) and sold at a certain price (P_{HT}).

In addition to the housing service flow, the household derives utility from consumption of a nonhousing good (c_t) and from the value of its retirement wealth (W_T). The latter consists of proceeds from the liquidation of housing equity plus the value of accumulated nonhousing assets. The purchase of the housing unit is financed from an endogenously determined combination of the household's initial wealth endowment (W_0) and a home mortgage loan.

Mortgage loans are available at a fixed exogenous interest rate r_m. They require continuous interest only payments r_mM, where $M=mP_{HO}H$ and m is the proportion of the purchase price ($P_{HO}H$) of the home which is debt financed.[2] The principal (M) is due upon sale of the house, here $t=T$. Home purchasers may acquire any loan amount on these terms up to the value of the housing collateral; ie. $O \leq m \leq 1$. No other constraints on the size of M are exogenously imposed, but no principal payments are permitted prior to sale of the house, and no additional mortgage financing is available. Thus, once chosen, the debt position (M) remains in effect until discharged at $t=T$.

In principle we allow households to borrow in the form of nonmortgage debt but we assume this debt bears a fixed exogenous cost $r_d > r_m$. Consequently, financing the home purchase with nonmortgage debt would be suboptimal. Moreover, we adopt a maintained hypothesis of Ranney's which stipulates that when households solve their maximization problem to determine the optimal quantity and time path of expenditures, they realize a solution which produces positive nonhousing wealth at every $t > 0$. This assumption assures that, having acquired their homes, households do not choose to borrow in order to achieve the optimal consumption path. The hypothesis can be stated as $A_t^* > 0$, $0 < t < T$, where A_t^* represents

the desired stock of nonhousing assets at t. Thus, optimizing households will continuously choose to hold no nonmortgage debt.

In turn, the assumption $A_t^* > 0$ serves the purpose of removing any effect of the time path of income on the optimal allocation of expenditure among h,c_t and W_T; only the present value of lifetime income is relevant. However, at t=0, an imposed nonnegative net worth constraint may restrict H (and h) independently of the size of full lifetime wealth. This constraint will be effective when $r_m > r$, where r is the certain return available on the nonhousing asset. In this case there is a kink in the budget line representing a discontinuous increase in the marginal user cost of housing when financed by mortgage debt rather than by W_0[3].

Following Ranney we can reduce the problem from a three good to a two good model by defining

$$(1) \qquad V(H,G) = \max_{c_t, W_T} \int_0^T U(\phi H, c_t)\,dt + F(W_T)$$

subject to

$$(2) \qquad G = \int_0^T P_t c_t e^{-rt}\,dt + W_T e^{-rT}$$

where p_t is the exogenously given price of the nonhousing consumption good (c) at time t. V(H,G) is a lifetime utility function concave in H and G and all the p_t and r are exogenous.

Utility is maximized subject to the budget constraint:

$$(3) \qquad W_0 + \int_0^T E_t e^{-rt}\,dt + (P_{HT} H - M) e^{-rT} = \int_0^T (r_m M) e^{-rt}\,dt + (P_{H0} H - M) + G$$

where E_t represents household earnings from labor services at time t. Equation (3) states that the present value of lifetime wealth, composed of the initial endowment, the present value of human capital earnings and the present value of terminal housing equity, is expended on housing in the form of interest payments and the downpayment, on the nonhousing consumption good and on terminal wealth, the latter two expenditures being the components of G. Once the optimal amounts H^*, G^* are determined, the first order conditions determine the separate allocations to c_t^* and W_T^*.

Our interest, however, is focused on determining the M^* that is consistent with utility maximization and on the relationship of M^* to H^*. In order to understand the role of m (the proportion of H which is mortgage financed), we specify the first order condition from which H^*, G^* are determined, contingent upon m, by setting $\frac{\delta V}{\delta H} + \frac{\delta V}{\delta G}\frac{\delta G}{\delta H} = 0$ which yields

$$(4) \qquad V_H + V_G\left[(P_{HT} - mP_{H0})e^{-rT} - mP_{H0}\int_0^T r_m e^{-rt}dt - (1-m)P_{H0}\right] = 0$$

Condition (4) equates the marginal utility of expenditure on housing with the opportunity cost (the marginal utility of G foregone), where the marginal utility of housing expenditure includes both the utility of housing services consumed from t=0 to T and the utility at t=T of the accrued return (via house price appreciation) from investment in housing.

Examination of the budget constraint (3) shows that feasible H,G combinations are also a function of m, but whether a larger m allows more or less H, G consumption depends upon the relationships between P_{H0} and P_{HT} and r_m and r. In a perfect foresight model we must expect

$P_{H0} > P_{HT}e^{-rT}$; otherwise, the effective price of housing services would be negative for housing acquired with W_0, and all W_0 would be invested in housing regardless of the magnitude of W_0.

Given a positive price of housing services, the relationship between r_m and r will be critical in determining both H^* and the optimal debt ratio, m^*. Supposing H is determined optimally, we can see how m^* is driven by r_m/r by defining the Lagrangian objective function

$$(5) \qquad L = V(H,G) + \lambda_1(\bar{m}-m) + \lambda_2(m-\underline{m});\ \lambda_1, \lambda_2 \geq 0$$

where $\bar{m}$ and $\underline{m}$ are respectively the upper and lower boundaries for m.

Since m affects V(H,G) only through G, we can maximize (5) by setting

$$(5a) \qquad \frac{\delta V}{\delta G}\frac{\delta G}{\delta m} - \lambda_1 + \lambda_2 = 0$$

where $\lambda_1 > 0$, $\lambda_2 = 0$ if $m = \bar{m} = 1$ and $\lambda_1 = 0$, $\lambda_2 > 0$ if $m = \underline{m}$ where $\underline{m} = (P_{HO}H - W_0)/P_{HO}H$ if $P_{HO}H > W_0$ and $\underline{m} = 0$ if $P_{HO}H \leq W_0$. The upper boundary $\bar{m}=1$ reflects our assumption that households can borrow up to the value of the home purchased. The lower boundary $\underline{m}=0$, applicable to 'wealthy' households, reflects an implicit assumption that home mortgage debt cannot be shorted. The other lower boundary, applicable to the 'nonwealthy', follows from the assumption above that $r_d > r_m$. Thus (5a) becomes

$$(5b) \qquad \frac{\delta V}{\delta G}\left(P_{HO}H - P_{HO}He^{-rT} - P_{HO}H\int_0^T r_m e^{-rt}dt\right) - \lambda_1 + \lambda_2 = 0$$

which can be simplified to

(5c) $$1-e^{-rT} - \int_0^T r_m e^{-rt} dt - \gamma_1 + \gamma_2 = 0$$

where $\gamma_1 = \lambda_1/(V_0 \cdot P_{H0}H)$ and $\gamma_2 = \lambda_2/(V_0 \cdot P_{H0}H)$ which further reduces to

(5d) $$(1-r_m/r)\,(1-e^{-rT}) - \gamma_1 + \gamma_2 = 0$$

Therefore, m^* is simply a function of the relationship between r_m and r. If $r_m=r$, then the first term in (5d) is zero, $\gamma_1=\gamma_2=0$ and m^* is indeterminate. However, if $r_m < r$, the first term is positive and $\lambda_1 > 0$. Thus, utility maximization requires mortgage debt maximization; ie. $m^*=1$ and $M^* = P_{H0}H$. In this case the Jaffee and Rosen proposition applies: home purchasers borrow all that they can. Both r_m and r should be interpreted as after tax rates; therefore assuming $r_m < r$ implicitly presumes that home mortgage interest is deductible in computing taxable income.

In Canada, mortgage loan interest generated from financing purchase of a principal residence is not deductible. Thus, in the Canadian context we should expect $r_m > r$. In this case the first term of (5d) is negative; thus $\lambda_2 > 0$ and utility maximization requires minimization of mortgage debt. If $W_0 \geq P_{H0}H^*$, this implies $M^*=0$; if $W_0 < P_{H0}H^*$, then $M^*=P_{H0}H^*-W_0$.

B. Allowing Mortgage Recontracting by Nonmovers

The model as formulated imposes two major market imperfections which restrict the ability of households to maximize lifetime utility. First, due to some combination of housing unit lumpiness and the transaction costs of moving, households are constrained to a single

housing unit over their $t = 0$ to $t = T$ horizon. Second, again presumably due to transactions cost imperfections, given H, households are restricted to a single unalterable nominal debt position (M^*) over $t = 0$ to T. In order to focus upon the optimal demand for mortgage debt, we retain the assumption that H, once determined, is locked in, but, given H, we permit costless mortgage recontracting so the household is continuously able to choose M_t^* to be $0 \leq M_t^* \leq P_{Ht}H$. This is achievable with a continuous open line of credit at the interest rate r_m and a continuous costless option to prepay any amount of principal.

Permitting continuous mortgage contracting significantly complicates the optimization of c_t, W_T, since a second investment option is introduced each period $t>0$. Households now can alter portfolio positions in housing equity as well as in the nonhousing asset. There are now two potential discount rates, r and r_m, which have roles in equation (1) to (5c). The appropriate rate is time and household specific and endogenous to the maximization process. Also, it is necessary to replace the maintained hypothesis $A_t^* > 0$ with $A_t^* \geq 0$; $W_t^* > 0$ for $t > 0$, where $W_t = P_{Ht}H + P_{At}A_t - M_t$, and P_{At} is the exogenously determined price of a unit of the nonhousing asset A. Since positive net worth is assumed always to be optimal after t=0, nonmortgage borrowing is not chosen so long as $r_d > r_m$, where r_d is the certain cost of nonmortgage debt.

Although the changes necessitated by allowing mortgage debt recontracting do make determination of c_t^* and W_T^* more complex, the nature of M_t^* optimization for $t>0$ remains unchanged from the t=0 decision above. Given H, households will recontract mortgage positions to continuously maintain the minimum mortgage debt consistent with H and W_t, as expressed in

(6) $M_t^* = P_m H - W_t$ if $P_m H \geq W_t$; $M_t^* = 0$ if $P_m H < W_t$

Thus, we know $A_t^* = 0$, $t>0$ so long as $M_t^* > 0$; that is, all household saving will be invested in mortgage debt reduction. An optimizing household can only desire to hold $A_j^* > 0$ at time $t=j$, when $M_j^* = 0$.

C. Potential Sources of Deviation from the Linkage of Housing and Mortgage Demands

In a certain world where mortgage debt can be recontracted without cost, define M_t^* to be a household's desired mortgage debt position at time t and $M_t^*(h^*)$ to be the demand for home mortgage debt that is singularly derived from the demand for owner occupied housing services (h^*). We have defined $M_t^*(h^*) = M_t^*$ by specifying a set of assumptions under which the only motivation for debt is to borrow the minimum amount necessary for the household to acquire the desired level of housing services (h^*). The assumptions necessary to ensure that $M_t^* = M_t^*(h^*)$ include:

i) $P_{HO} > P_{HT}\, e^{-n}$

ii) $r_d > r_m > r$

iii) $0 \leq m \leq 1$

and

iv) $A_t^* \geq 0$, $W_t^* > 0$ for all $t > 0$.

The linkage of $M_t^*(h^*)$ to housing demand operates in both directions. That is, only debt collateralized by the home is used to acquire h^*, and given W_t, $M_t^*(h^*)$ is the minimum debt position that allows the household to consume h^*. Thus, any observed mortgage debt in excess of $M_t^*(h^*)$ is generated by objectives unrelated to housing demand and any observed shortfall,

$M < M_t^*(h^*)$, necessarily implies that housing demand is partially financed by debt that is not collateralized by an owner-occupied home.

There are several reasons why households may systematically choose debt positions incompatible with the model's optimal $M^* = M^*(h^*)$. One potential reason we ignore is that some households, in attempting to smooth lifetime consumption, may desire negative net worth. In our model decomposing mortgage demand requires that liabilities created by borrowing be mirrored in assets; negative net worth is incompatible with this requirement. Thus, we restrict the discussion, and the sample selection in the empirical estimates below, to positive net worth households.

Households deviating from mortgage debt minimization may be conveniently classified into two cohorts. First, some households may utilize nonmortgage debt to finance their H^* positions. Second, and likely more important, some households, contrary to the model's prediction, may choose to hold $M_t^* > 0$; $A_t^* > 0$ simultaneously. We consider the rationale for and implication of each of these deviations in turn.

1. Financing Housing with Nonmortgage Debt

Housing may be financed with nonmortgage debt (D) substituting for M because, contrary to the model's assumptions i) $r_d < r_m$ or ii) $0 \leq m \leq k$; $k < 1$, ie. lenders impose a downpayment requirement or iii) there are sizable mortgage recontracting costs. Even though $r_d > r_m$ is generally plausible, if r_m is a function of the leverage ratio (Plaut, 1984) then the user cost of h^* may be minimized by employing a capital structure including both M and D. This will apply particularly to households that require a high ratio debt position to acquire (hold) H^*. A mix of M and D may also be optimal as a way of avoiding the impact of downpayment

constraints on the quantity of housing services attainable or as a means of reducing transactions costs. Significant transactions costs may be imposed upon some mortgage debt adjustments (eg. increases in M) made at times other than loan renewal.

2. Mortgage Financing of Nonhousing Consumption or Investment

There are several ways in which the relaxation of model assumptions could produce $M_t^* > M^*(h^*)$. First, if the assumptions regarding E_t and P_{HT} are relaxed to make their values uncertain, and at the same time recontracting imperfections are introduced in the mortgage market, then liquid nonhousing assets may generate utility at $t < T$. It is frequently assumed that optimal liquidity positions are functionally related to household holdings of consumer durables, in general (Pissarides, 1978), and owner occupied housing, in particular (Plaut, 1987). Under these circumstances liquid assets and owned housing may be viewed as joint products. If the optimal liquidity position attributable to $P_H H$ is $L^*(H)$, then $M_t^*(h^*)$ becomes

$$(7) \qquad M_t^*(h^*) = P_{Ht} H + L_t^* - W_t \text{ if } P_{Ht} H + L_t^* > W_t;\ M_t^*(h^*) = 0 \text{ if } W_t \geq P_{Ht} H + L_t^*$$

Second, $M_t^* > M_t^*(h^*)$ may be motivated by portfolio objectives. Suppose we further relax the model's assumptions by postulating that r and P_{HT} are both uncertain and uncorrelated. Then households making investment decisions based upon expected return and risk in a mean/variance portfolio choice model, will wish to diversify away unsystematic risk. Given that housing units are lumpy, indivisible assets, achieving the diversification objective is likely to require borrowing. Borrowing is rational if the risk reduction achieved exceeds the added risk exposure produced by levering the home. Given $r_m < r_d$ any borrowing is likely to consist, primarily, of 'excess' mortgage demand.

Finally, home equity may also be a prime source of capital for households whose investments include a joint product. Examples may include investment in consumer durables, second homes or investment real estate, where debt capital supports consumption or property management skills as well as finances an investment. Similarly, 'excess' mortgage debt on homes may provide working capital for household members' closely held business or professional interests. Moreover, debt may be required for households to be able to invest in special tax subsidized investments.

In determining the cost of mortgage debt used to finance nonhousing investment, after tax cost is relevant. Although Canadian tax law prohibits interest deductions on home mortgage debt used to purchase or improve an owner-occupied home, interest is deductible if the debt is seen to be financing eligible investments as opposed to consumption. In a world of continuous mortgage recontracting, all interest on excess mortgage debt (XM) is potentially deductible. Consequently, home mortgage debt utilized to finance nonhousing assets may carry a significantly lower after tax cost for higher bracket taxpayers than home mortgage debt used to finance the owner's residence.

D. Estimating the Magnitude of the Components of Home Mortgage Demand

In order to apply the model to a cross section data base dominated by non-movers, we must believe that households are in equilibrium with respect to their mortgage debt positions. Since home mortgage equity lines of credit are only in the development stage in Canada and prepayments are often restricted or incur significant penalties, the continuous recontracting assumption may seem inapplicable to mortgage markets. However, the Canadian market is characterized by very short term loans, and costless partial prepayment and monthly payment

adjustment options. In particular, during the early Eighties the five year rollover loans, which became ubiquitous by the end of the Sixties, were being renewed for terms of no longer than three years. At these frequent renewals households can increase as well as reduce their debt positions at relatively modest transactions costs.

To estimate the extent to which Canadian household mortgage debt positions are derived from housing demand ($M=M^*(h^*)$), we utilize the Asset and Debt microdata file produced by Statistics Canada from its 1984 Survey of Consumer Finances. This Survey records detailed balance sheet positions for the sampled economic family units and unattached individuals as of May 1984. Given the strong aversion of Canadian mortgage lenders during the early Eighties to any but very short term loans, it is reasonable to believe that, as of May 1984, a large proportion of owner occupiers would have recently recontracted their mortgage debt positions. The primary exception would consist of a cohort of older immobile households holding long term loans originated more than fifteen years before the Survey date. We effectively eliminate this cohort from the estimation by limiting the sample utilized to households with heads, and spouses, where present, under the age of forty.

To be sure we are dealing with single decision units (households), we also restrict the sample to observations consisting of a single family unit or a single adult. In order to ensure these households are operating in the same national mortgage market, we further limit the sample to households residing in large urban areas. Finally, to ensure that households have been financially capable of recontracting their home mortgage loans, we restrict the sample to households with employed heads.

In Table II-1 households are classified into two groups. Group I households are those not requiring mortgage debt ($M^*(h^*)=0$) while Group II households do 'require' home mortgage

debt to own their chosen house ($M^*(h^*) > 0$). The estimation process allocates each observed household into a mortgage minimization cohort ($M = M^*(h^*)$), a mortgage deficit cohort ($M < M^*(h^*)$) or an excess mortgage debt cohort ($M > M^*(h^*)$). A household in a mortgage minimization position is interpreted to satisfy the traditional two way housing demand-mortgage demand linkage. As seen above (Equation 7), households can satisfy the debt minimization criterion in two ways. Since mortgage debt cannot be shorted, 'wealthy' households (with $W \geq P_H H + L^*$) satisfy the $M^* = M^*(h^*)$ criterion if they are on a corner solution, $M = 0$. Other households meet the mortgage minimization objective by choosing $M = P_H H + L^* - W$.

In order to allow for lagged adjustments that arise, for example, when recontracting is restricted to discrete points, as well as for the unknown magnitudes L^*, we operationally define mortgage debt minimization for the latter group to be achieved if

$$(8) \qquad P_H H - W < M < (1+\alpha) P_H H - W; \; W < P_H H$$

is satisfied. Households are designated as being in a deficit position if their observed mortgage debt falls short of the defined 'minimum mortgage' and are classified as holding 'excess' debt (XM) if their mortgage position exceeds their 'minimum' debt. We report the distribution of households among these cohorts under three assumptions regarding the magnitude of α.[4] Observations are weighted by sample weights that take into account the Survey's stratification design. From our conceptual framework it follows that positive excess debt is used to finance assets other than principal residences.

Interestingly, Table II-1 shows that about eight percent of households (cohorts C and D) are in a mortgage deficit position; that is, they have utilized personal debt in whole or in part to finance their housing demand. Some households in Cohort D may have used personal debt

Table II-1
Distribution of Households by Mortgage Demand Cohorts (percent)

Cohort		$\alpha=0$	α=MIN (TLA/P_HH; .05)	α=MIN (TLA/P_HH; .10)
I	$M^*(h^*)=0$			
A.	M=0	13.7%	13.7%	13.6%
B.	M>0	22.6	21.0	20.6
II	$M^*(h^*)>0$			
C.	M=0	1.1	1.1	1.2
D.	M>0; XM<0	7.1	7.2	7.2
E.	$M=M^*(h^*)$	0.1	3.7	4.5
F.	M>0; XM>0	55.4	53.2	52.8
Total		100.0	100.0	100.0

Notes:

1) Number of observations = 1050; each observation is weighted by its Survey stratification weight.

2) Full cohort definitions are:

A: $W > (1+\alpha)P_H H,\ M = 0$
B: $W > (1+\alpha)P_H H,\ M > 0$
C: $W < (1+\alpha)P_H H,\ M = 0$
D: $M > 0,\ XM < 0,\ W \leq (1+\alpha)P_H H$
E: $(P_H H - W) < M < ((1+\alpha)P_H H - W),\ W \leq P_H H$
F: $W \leq (1+\alpha)P_H H, M > 0,\ XM > 0$

3) TLA = Total Liquid Asset Holdings. Liquid asset include cash, all forms of deposits and most nonmortgage debt securities. P_HH=Market value of house; M=observed mortgage debt; $M^*(h^*)$=optimal mortgage debt derived from the demand for housing; XM=M-$M^*(h^*)$; W=net worth.

either because they were rationed to $M < M^*(h^*)$ or, given an endogenously determined interest rate, because they reached a debt ratio where at the margin $r_m > r_d$. Based upon generally accepted income coverage and debt ratio underwriting guidelines, we estimate that about 23 percent of households in Cohort D may have negative XM^* as a result of being rationed.[5] However, the majority of mortgage 'deficit' households do appear to have had greater mortgage borrowing power than they elected to use. Thus, for these households either $r_d < r_m$ at the margin or personal debt involves lower transactions costs of recontracting than mortgage debt.

More importantly, Table II-1 shows the incidence and quantitative significance of mortgage demand derived from nonhousing objectives. When we assume $\alpha = 0$, some 87 percent of Group II households and, surprisingly, 62 percent of 'wealthy' Group I households hold excess mortgage debt positions. The second and third columns of Table II-1 allow for the liquid asset demand joint with homeownership, noise, and the discreteness of recontracting opportunities, by creating a broad band of $M=M^*(h^*)$ for Group II households. However, this allowance only shifts a modest proportion of these households from the excess debt to debt minimization cohorts. Thus, only about 14 to 18 percent of households (cohorts A and E) hold the minimum debt positions designated to be optimum by the certainty model.

The conclusion that a large proportion of young, urban households hold excess debt positions does not necessarily imply that these holdings are large relative to mortgage debt derived from housing demand. For each assumed α in Table II-1, we also computed excess debt (XM) amounts, again weighted by each observation's survey weight, where $XM=M-((1+\alpha)P_HH-W)$ if $(1+\alpha)P_HH>W$ and $XM=M$ if $(1+\alpha)P_HH<W$. For this purpose we treated the negative XM positions of the deficit cohorts C and D as equal to zero. As a percentage of total mortgage debt for all cohorts, excess debt accounts for 39.8% when $\alpha=0$ and 35.7% and

34.1% respectively, under the next two α assumptions in Table 1. Taking the last case (34.1%), the excess debt position is composed of 100 percent of the mortgage debt positions of Group I households and 18.5 percent of the total mortgage debt of Group II households. About 56 percent of excess debt is accounted for by the 'wealthy' Group I spending units although they account for only 28 percent of the households holding excess debt positions.

Not all Group I households are wealthy in relation to Group II households; some households of modest wealth do not require a mortgage because they appear to have very limited tastes for housing. Nonetheless, households with stronger tastes for using debt to finance investment real estate, businesses, portfolio diversification or other objectives may well be disproportionately represented in Group I. Also Group I households are more easily able to justify the deductibility of interest on home mortgage debt since all such debt can be associated with the financing of eligible investments.

In contrast, Group II households are faced with the task of justifying to tax authorities the allocation of home mortgage debt between the principal residence and eligible investment activities. In some cases this may be difficult to establish without the use of a separate junior mortgage. Consequently, Group I households may be the beneficiaries of lower marginal after tax costs of debt than Group II households in otherwise comparable tax positions. In any case it appears that any explanation of excess mortgage demand needs to be focused particularly on younger households for whom $M^*(h^*)=0$.

E. Summary and Implications

We have modelled home mortgage demand in a manner that permits decomposition of that demand into the amount derivable from housing demand and the component representing

financing of nonhousing assets. The housing demand component is identifiable from a model in which optimal debt is equal to the minimum home mortgage demand required to purchase (hold) the principal residence selected. This debt minimization position is modelled so its expression is invariant whether the optimal housing asset is determined simultaneously with the optimal debt or the optimal mortgage debt is found conditional upon a predetermined housing asset.

The assumptions which produce a debt minimization optimum appear particularly applicable to the Canadian context. However, there exist transactions cost, portfolio objective and tax rationales for chosen debt positions to differ significantly from the model's optimum even in the Canadian tax environment. The Statistics Canada Survey of Consumer Finances is utilized to allocate each sampled household to one of three mortgage demand cohorts; ie. debt minimization, deficit or excess demand. A sizable majority of households do appear to have positive excess demand positions and these excess debt positions, financing nonhousing objectives, appear to amount to at least one-third of total home mortgage demand.

These results suggest that 'excess' demand is of sufficient magnitude to cast doubt upon the validity of the linkage hypotheses. Consequently, the modelling of the determinants of 'excess' mortgage demand appears to be a prerequisite to an understanding of household capital structure and portfolio choice decisions.

In Chapter III we shall allow for these findings in modelling and estimating an excess demand function using the same 1984 database.

Footnotes to Chapter II

[1] Many such examples of supply oriented modelling exist, ranging in time from Guttentag (1961) to Dokko, Edelstein and Urdang (1990).

[2] Ranney assumes the mortgage is continuously amortizing with the amortization period equal to T. We assume an interest-only loan in order to cleanly identify the cost of debt with the payment rate and to associate all changes in mortgage debt balances with explicit recontracting decisions.

[3] Jones (1990) provides evidence of a particularly strong role for initial wealth in constraining the housing demand of those young Canadian households that are unaffected by lender imposed credit constraints.

[4] In principle, α in equation (7) should be household specific and functionally related to income uncertainty, the optimal c_t path and portfolio preferences. We attempted to estimate desired liquidity positions by regressing liquid asset positions upon household income, occupation, wealth and life cycle variables but none of a variety of specifications were successful.

[5] For this purpose we define a household debt position to be potentially restricted by lender rationing or a high marginal mortgage cost if $.15M/INC > .30$ or $M/P_H H > .80$ or $XM/XCOL > .80$ where INC is the household 1983 income, $XM = M-(1.1P_H H-W)$ and

XCOL=W-0.1P_HH. Each household is weighted by its Survey sample weight in computing the proportions affected. About 12.3 percent of Cohort D households appear restricted under the M/P_HH guidelines, 2.5 percent by the combination of limited net worth and the liquidity requirement, which makes the XM/XCOL rule binding, and 8.3 percent by the income coverage rule.

CHAPTER III

ESTIMATION OF THE DETERMINANTS OF EXCESS MORTGAGE DEMAND FOR CANADIAN HOUSEHOLDS

In Chapter II a method is proposed for decomposing home mortgage debt into that portion derived from the demand for housing and the component derived from the demand for nonhousing assets. By isolating the housing finance component of mortgage demand, the demand for mortgage debt is generated by the demand for nonhousing assets and the simultaneous financing decision. We label this source of mortgage demand 'excess demand' and in this Chapter, report estimations of excess mortgage demand for Canadian households. Results of similar estimations using U.S. household data are reported in Chapter IV.

In Section A we model the household choice problem. In principle, it would be illuminating to estimate excess mortgage demand at the time the household purchases a home. However, no database exists which contains a sufficient sample of home purchases to support such an estimation. Therefore we estimate debt functions on cross-section data and model households whose housing demand and optimal housing-driven mortgage debt are predetermined. In order to motivate the demand for excess debt we relax an assumption in Chapter II's certainty model by assuming a vector of risky assets is available. Setting aside H^* and $M^*(h^*)$ (see Chapter II) we assume the household maximizes utility, subject to the budget constraint, as if

it was optimizing over the mean and variance of a portfolio of nonhousing assets. We emphasize the typically incomplete character of household portfolios in this optimization.

In Section B we review hypotheses about the creation of asset 'tastes' which determine which assets are chosen from menu of available asset types. This leads to the base specification of the excess debt demand function which is to be estimated.

In Section C sample selection issues are discussed and rationales for subsample selection provided. Because there is no extant empirical literature providing results on mortgage demand estimation we initially estimate a reduced form demand equation. These results are examined for clues as to what may be important to endogenized. The reduced form results are reported in Section D.

In Section E we endogenize asset 'tastes' by estimating asset demand functions first on measured wealth and household attributes, and subsequently on endogenized household nonhousing wealth. These estimates, which usually take the form of predicted probabilities, are then entered as regressors in the excess debt demand regressions. We conclude the chapter with a brief summary of the conclusions and their implications.

A. The Household Choice Problem

In Chapter II we modelled the determination of the optimal flow of housing services (h^*), the asset from which these services are produced (H^*) and the optimal amount of debt ($M^*(h^*)$). Under the assumption that the after-tax cost of home mortgage debt (r_m) is less than the alternative source of borrowing (r_a), the optimal debt consists solely of home mortgage debt. Moreover, assuming $r_m < r$, where r is the certain riskless rate of return on the nonhousing asset, the household's debt position should represent the minimum borrowing necessary to

finance the endogenously determined H^*. In this sense we regard M^* as strictly deriving from the demand of housing.

Once H^* is chosen, we have treated housing consumption as predetermined and unalterable. This assumption represents the stylized fact that, presumably due to large transaction costs, ownership typically involves an extended tenure. With continuous mortgage recontracting, we show in Chapter II that, at any time 't', optimal home mortgage debt is

$$(1) \qquad M^*(h)_t = \begin{cases} 0 \text{ if } W_t \geq P_{Ht} H \\ P_{Ht} H - W_t \text{ if } W_t < P_{Ht} H \end{cases}$$

where, as before, P_{Ht} is the market value of a unit of housing at time 't', H is the predetermined number of units of housing held and W_t is household net worth. Given the model's assumptions, households continuously adjust their debt position to the minimum amount consistent with the predetermined level of housing services (h).

We also show in Chapter II that, contrary to the predictions of the certainty model, few Canadian households hold mortgage debt positions that are consistent with $M^*(h)$. This is the case even when we interpret $M = M^*(h)$ if M falls within the range $(P_H H - W) < M < ((1 + \alpha)P_H H - W)$, for the 'nonwealthy' $(W < P_H H)$, and restrict the 'wealthy' designation to those with $W > (1 + \alpha)P_H H$.[1] Thus characterizing deviations of observed mortgage debt positions (M) from the housing-driven optimum $(M^*(h))$, we identify the 'excess' debt position (XM) as

$$(2) \qquad XM_t = M_t - M_t^*(h)$$

For some households, the measured XM is negative, indicating that nonmortgage debt is being used to finance the housing asset. For most households, XM is positive indicating that home mortgage debt is used to finance nonhousing asset positions. Our interest in this Chapter is to empirically explore the determinants of the demand for XM.

To provide a motivation for households to desire XM^*, it is necessary to relax some assumptions in the certainty model. As suggested in Chapter II possible modifications may include the recognition that the housing price at tenure termination (P_{HT}) is uncertain, allowing for risky nonhousing assets in addition to a riskless (liquid) asset, recognizing the existence of transactions costs and nonneutral taxes and recognizing the possible interaction between certain asset holdings and the generation of income from human capital.

For example, we can motivate the analysis of the household choice problem by relaxing the assumption that there exists a single riskless nonhousing asset with an exogenous certain return, r, and introduce a vector of risky assets A_j with uncertain returns r_j. Assuming the housing decision has been made, the household desires to maximize

$$(3) \qquad V(G) = \int_0^T U(c_t)\,dt + F(W_T)$$

subject to (4) $$G = \int_0^T p_t c_t e^{-rt}\,dt + W_T e^{-rT}$$

where, as before, c_t is the nonhousing consumption good, W_T is the total wealth at the predetermined time T when the owned housing position is liquidated, and the p_t represent certain prices of the nonhousing consumption good.

Although h and H are unalterable during the period $0 < t < T$, the household can

continuously alter the c_t^*, W_t^* positions and continuously choose an optimal portfolio of A_{tj}^*. This optimal portfolio is financed by nonhousing net worth (NHNW) and 'excess' debt (X) where

$$(5) \qquad NHNW = \begin{cases} 0 \text{ if } NW \leq P_H H \\ NW - P_H H \text{ if } NW > P_H H \end{cases}$$

and

$$(6) \qquad X = \sum_j A_j P_j - NHNW$$

and where A_j represents the number of units of asset j held and P_j the unit price of asset j. For simplicity, assume X consists solely of home mortgage debt borrowed at a cost r_m and assume the A_j generate uncertain returns r_j. Further assume that the excess debt (X) requires continuous interest payments.

Suppose the utility function (3) is strictly concave and additively separable over time. Each period (reinitialed t=0) the household acquires a portfolio of A_j financed by $NHNW_0 + X_0$. We suppose this decision is made as if the portfolio acquired this period will be held, without alteration, to the fixed and certain time T and that the excess debt balance (X) will be repaid at t=T. Then (3) is maximized at t=0 subject to the budget constraint

$$(7) \qquad NHNW_0 + X_0 + \int_0^T E_t e^{-rt} dt + (P_{HT} H - M) e^{-rT} + \int_{j=1}^{n} \int_{t=0}^{T} r_{jt} A_{jt} dt$$

$$= \int_0^T r_m M e^{-rt} dt + \int_0^T r_m X e^{-rt} dt + X e^{-rT} + G$$

where, as before, E_t represents the certain flow of labor earnings and r is the certain return on the riskless asset. Returns on the J risky assets (r_j) are uncertain, but these assets are continuously tradable at zero trading costs.

Following King and Leape (1984), if asset returns follow a continuous time Markov process and do not exhibit jumps, households can be viewed as choosing the vector A_j, subject to the budget constraint, as if they were optimizing over the mean and variance of the portfolio of A_j given $NHNW_0$. With these simplifications one can treat the *i*th household as maximizing the function

$$(8) \qquad \Pi^i = \Pi^i[\mu^i, (\sigma^i)^2]$$

subject to the budget constraint

$$(9) \qquad \sum_{j=1}^{n} a_j^i = NHNW^i + X^i$$

where μ^i is the mean return on the *i*th household's portfolio, $(\sigma^i)^2$ the variance of the portfolio, a_j^i the household's demand for asset j, $NHNW^i$ is as defined in (5) above and X^i is the amount borrowed at the nonstochastic rate r_m. We suppose X is constrained to not exceed $P_H H - M^*(h)$ and each A_j is restricted to be nonnegative by an assumed constraint on short sales.

We follow King and Leape (1984) by introducing household (asset) specific tax rates (t), and thus characterizing the mean portfolio return as

$$(10) \qquad \mu^i = \sum_j a_j^i \mu_j (1-t_j^i) - r_m X^i (1-t_x^i)$$

where μ_j is the mean pretax return per dollar invested in j, t_j^i is the ith household's effective tax rate on returns from j and t_k^i is the tax rate against which interest payments are deductible. The variance of the portfolio returns is

$$(11) \qquad (\sigma^i)^2 = \sum_j \sum_k a_j^i a_k^i cov_{j,k}(1-t_j^i)(1-t_k^i)$$

where $cov_{j,k}$ is the covariance of the per dollar returns on assets j and k. Maximization of (8) subject to (9), the constraints on X and the nonnegativity constraint on a_j^i demand, yields a set of first order conditions from which the subset of A_j the household chooses to hold in positive amounts is determinable (King and Leape, 1984). In principle inversion of the first order conditions will yield a system of asset demands conditional on the combination of assets chosen to be held in positive quantities.

This approach to modelling asset (debt) choice emphasizes that households typically hold incomplete portfolios. We demonstrate below that this is indeed dramatically the case for both Canadian and U.S. households even when assets are grouped into a small number of asset classes. There exists no consensus in the literature on why portfolios are often incomplete. However, part of the answer may lie in Chapter II's showing that for younger owner occupiers, the lumpiness of the housing asset (H) results in a sizeable majority of these households possessing zero nonhousing wealth positions. Thus all risky nonhousing asset positions must be financed with debt, and risk averse households may desire only modest holdings of nonhousing assets.

The effect of this consideration is compounded if transactions costs of asset trading are nonnegligible and holding costs are high. Indeed, differential trading and holding (asset

management) costs can affect the nature of the assets held in positive amounts. Thus Goldsmith (1976) shows that when an asset with high transactions (trading) costs is selected by a household, it will absorb a larger proportion of the optimal portfolio than a low transactions cost asset. High management costs also act to reduce the number of assets held in an optimal portfolio (King and Leape, 1984), and economies of scale in management costs of specific assets will further tend to concentrate the portfolio in assets characterized by such economies. Other institutional restrictions or nonneutralities that may dictate zero positions in certain assets are constraints on short sales (Auerbach and King, 1983) and the asset and household specific nature of the tax treatment of asset returns and expenses (Feldstein, 1976) accounted for in equations (10) and (11). The latter nonneutrality may create strong tax clientele effects in asset choice.

B. Specification and Variable Selection

We have identified several possible reasons households may be motivated to hold positive excess debt positions. First, if returns on the housing and nonhousing assets are uncertain and negatively correlated, excess borrowing may reflect a portfolio diversification objective. Thus, in contrast to the certainty model, $A_j > 0$ is compatible with $M^* > 0$. In particular, there is considerable evidence that adding financial assets to a real estate (owner-occupied-housing) dominated portfolio will significantly reduce unsystematic risk.[2] Borrowing to add financial assets is rational if the benefits from unsystematic risk reduction exceed the loss of utility produced from the risk exposure of additional leverage. The diversification motive is also tested by inclusion of net wealth as a regressor in excess debt estimation. As discussed in Chapter I, the diversification hypothesis predicts a negative sign on net wealth. We attempt to deal with all the shortcomings of the Chapter I approach in estimating excess demand in this chapter.

Second, excess debt may be driven by tastes for lumpy consumer durables. In the 1984 Statistics Canada Survey of Consumer Finances (SCF) we use in this chapter, the only consumer durable information is the estimated market value of household motor vehicles.

Third, excess debt positions may be motivated by the expectation of returns from investments with significant tax shelter characteristics. Investment real estate and Registered Retirement Savings Plan accounts are tax shelter assets identifiable in the Survey.

Finally, some assets may complement income producing human capital attributes possessed by household members. Thus, entrepreneurs and self-employed professionals may finance business assets with home mortgage debt. Similarly, persons with property management skills may be motivated to lever their home to provide funds to invest in investment real estate.

Willingness to incur excess debt depends upon the degree of the households risk aversion. This aversion may depend, in turn, upon household economic and sociodemographic attributes such as age, marital status, dependents, current wealth, permanent income, volatility of income and financial sophistication. Given asset tastes and risk aversion, the cost of mortgage debt is critical to the determination of the extent to which households elect to hold debt financed nonhousing assets. The cost of debt is, in part, household specific, since household attributes affect lenders evaluation of credit quality and determine the household's marginal tax rate.

Although interest on debt used to finance purchase of, or capital improvements in, a residence is not deductible in the Canadian tax system, interest on debt used to finance eligible investments is deductible.[3] Although RRSP contributions, second homes and consumer durables are not eligible investments, interest on debt financing of such positions may nonetheless be deductible if the financing can be plausibly attributed to eligible investments. Therefore, all

interest on excess debt is potentially deductible. The marginal tax rate is expected to be especially important where tax shelter investments are debt financed.

With these hypotheses in mind we estimate a function of the form

$$(12) \qquad XD = \alpha + \beta_1 ASSET + \beta_2 TXRATE + \beta_3 AVERSE + \epsilon.$$

Initially we compute XD = XMORT + PDEBT where PDEBT is the balance owing on all forms of personal and consumer debt not securitized by the household's principal residence. Subsequently, and primarily, we estimate (12) with XMORT, or a modified version thereof, as the dependent variable. In this case, PDEBT is included as a regressor to test the extent that MORT and PDEBT are substitutes in financing nonhousing assets. Some suggestion of substitutability was found in Chapter II with the discovery that there exist households who (partially) finance their principal residence with PDEBT. On the other hand, PDEBT may be largely linked to the financing of specific types of nonhousing assets, including consumer durables, in particular.

The estimation is based upon the presumption that observed households are in equilibrium with respect to their mortgage debt positions. Moreover, from the choice perspective the household should value home mortgage debt at market, not book, value. As in Chapter II we achieve these objectives empirically by restricting the sample used to households whose head, and spouse, if present, is under the age of 40. In the context of observing households in 1984, this ensures all households in the sample have quite short term loans. This means that households will have recently assessed their mortgage debt positions; costless partial prepayment provisions also reinforce the credibility of the maintained hypothesis that households are in debt equilibrium. Moreover, restricting the sample to households with very short term mortgage

loans means that book values are a credible approximation to market value. This is important since no information on loan terms is provided in the 1984 SCF that would permit market value estimation.

The variable ASSET in (12) represents a vector of asset classes observed in household portfolios. Generally these asset positions are measured as shares of nonhousing assets or as the presence (absence) of certain asset classes or combinations of asset classes. In order to make examination of the effect of asset combinations on the demand for excess debt tractable, we aggregate the seventeen asset classes, for which positions are reported in the 1984 SCF, into five cohorts. These cohorts are FIN (financial assets), REAL (investment real estate and second homes), BUS (assets used in a closely held business or profession), RRSP (registered retirement savings plan account balances) and MVEH (the value of motor vehicles owned). This grouping was selected in order to permit testing of the hypotheses posed above.

Even with these gross asset categories, the summary of holdings in Table III-1 reflects the extent of incompleteness that characterizes household portfolios. The sample used in Table III-1 is identical to that used in the regression analyses reported below. For this sample, the mean number of assets held from the five asset menu is 2.06. The data in Table III-1 suggests that ownership of the illiquid BUS or REAL assets is positively associated with nonhousing wealth. Consistent with the trading cost and holding cost arguments reviewed above, ownership of these assets does appear to be associated with disproportionate portfolio shares in these assets.

The last two variables in (12) represent the impact of household economic and sociodemographic attributes on expected asset returns and the cost of debt (TXRATE), and on household risk aversion toward holding specific asset types and toward financing nonhousing

Table III-1
Household Portfolios for the Sample
Used in Estimating Excess Debt Demand

	REAL	BUS	FIN	RRSP	MVEH
Percent Holding the Asset	12.7	12.8	43.7	40.0	97.1
Mean Asset Share (%)	6.3	6.5	14.1	11.3	61.7
Conditional Mean Asset Share (%)	49.9	50.9	32.3	28.5	63.5
Conditional Mean NHNW ($)	66148	91288	34412	35682	18997

Notes: Asset shares are calculated as a percentage of Net Nonhousing Assets (NHA) = REAL + BUS + FIN + RRSP + MVEH. In the second row shares are computed over the whole sample (N=771) including those with zero holdings. In the third row, calculations are based only on those holding a positive position in the identified asset. Nonhousing net worth (NHNW) means are also calculated only on those holding positive positions in the asset in question; however, zero NHNW positions are included in the mean calculations. The mean NHNW for the N=771 sample represented in the table is $19282.

asset positions by levering the principal residence (AVERSE). Given the apparent discontinuities in asset (debt) decisions that produce sizeable demands once a household commits to a positive holding, TXRATE should measure the household's appropriate marginal tax rate ex ante, rather than after the investments (debts) are in place. Therefore, we estimate TXRATE as the marginal tax rate for the highest income member of the household, using income and relevant family attributes, but without using information on tax shelter investments (other than RRSP contributions) or on deductible interest payments. Since the 1984 SCF reports 1983 income the calculation is performed on the basis of the 1983 tax laws for the Province in which the household is resident.[4]

A sizeable number of household attributes are used to proxy household risk aversion. These include information on household wealth, income, dependents, and data on members ages, occupations, education, country of birth, year of immigration and sex. In general, we expect risk aversion to decline with wealth, income, age and education and to be lower for financially sophisticated professionals or managers. On the other hand, risk aversion may be positively associated with number of dependents or with certain immigrant groups.

C. Sample Selection, Variable Definition and Summary Statistics

In the empirical portion of Chapter II, we used a subsample of the 1984 SCF which restricted observations to nuclear families residing in large urban areas with employed heads, who are, along with any spouses, under the age of 40. These restrictions produced a sample of 1050 households. In performing the excess debt estimations reported below, the sample size was further reduced to 771. Most of this reduction resulted from the loss of households with missing values in variables required to calculate the marginal tax rate. Most of the remaining deletions

were households deemed to be potentially credit constrained. Since we wish to estimate demand functions on the assumption households are in debt equilibrium we eliminated from the sample households with existing loan balances in excess of 80 percent of the market value of their home, and households whose estimated mortgage payments exceeded 30 percent of their gross income.[5]

In addition, because of questions about data quality, we eliminate households whose homes are partially rented or used for business purposes. The modelling which motivates the empirical estimation does not recognize negative net worth or negative asset positions, therefore, we restrict the sample to households with nonnegative values for net worth and each of the five asset classes. We also require positive liquid assets and home mortgage balances which are no greater than the market value of the home. Table III-2 provides a glossary of definitions of variables used in the demand estimation and Table III-3 provides means and standard deviations for these variables, excepting the 0,1 dummies.

Finally, we have to determine whether to estimate excess debt demand separately for the 'wealthy' and 'nonwealthy' cohorts, where the 'wealthy' are cases where NHNW $\geq (1 + \alpha)$ $P_H H$ and the 'nonwealthy' the residual. It will be recalled that NHNW is definitionally equal to zero for the 'nonwealthy' and NHNW = NW - $(1 + \alpha)$ $P_H H$ for the 'wealthy.'

The case for estimating separate functions is based on two considerations. First, the Chapter II results indicate that excess mortgage debt is held disproportionately by the 'wealthy.' Second, XMORT is a censored variable but the censoring is different for these two cohorts. Since, for the 'wealthy' XMORT $\geq$ MORT, XMORT is censored to zero from below, and to HOUSE from above.[6] However, the 'nonwealthy' can possess negative XMORT positions since XMORT = MORT - MINMORT for the 'nonwealthy.' This cohort is censored from below by

Table III-2
Variable Definitions

HOUSE	Market value of principal residence
MORT	Balance outstanding on home mortgage debt
TLA	Total Liquid Assets: including all forms of deposits and certificates, Canada Savings Bonds and marketable bonds
LIQ	Min (TLA; .1HOUSE)
NW	Household net worth
NHNW	Nonhousing Net Worth = NW - HOUSE - LIQ if NW ≥ (HOUSE + LIQ); otherwise equals zero
NHNWSQ	$(NHNW)^2$
DNHNW	A 0,1 dummy variable taking the value '1' if NHNW > 0
MINMORT	Equals HOUSE + LIQ - NW if (HOUSE + LIQ) > NW; otherwise equals zero
XMORT	Equals MORT if NW > (HOUSE + LIQ); otherwise equals MORT-MINMORT
MXMORT	Equals zero if XMORT < 0; otherwise equals XMORT
EARN	Total Household Income from Human Capital
EARNSQ	$(EARN)^2$
NOEARN	Number of Earners in Household
TXRATE	Calculated marginal income tax rate for the highest income member of the household (in percent)
REAL (R)	Equity in Real Estate other than the principal residence; R is a dummy variable that takes on the value '1' if REAL > 0 and is otherwise equal to zero.

BUS (B)	Equity in businesses or professions; B is a 0,1 dummy taking the value '1' if BUS > 0.
RRSP (P)	Accumulated value of Registered Retirement Savings Plan Accounts; P is a 0,1 dummy taking the value '1' if RRSP > 0.
FIN (F)	Total financial assets including TLA, common stock, mutual fund shares, and mortgage loans less LIQ and RRSP; F is a 0,1 dummy taking the value '1' if FIN > 0.
MVEH (M)	Market value of motor vehicles devoted primarily to personal use; M is a 0,1 dummy taking the value '1' if MVEH > 0.
PDEBT	Balance outstanding on all forms of nonmortgage personal debt.
XDEBT	Equals XMORT + PDEBT
TA	Total Assets
NETA	Equals TA - HOUSE - LIQ
RENA	Equals REAL ÷ NETA
BUSNA	Equals BUS ÷ NETA
REBNA	Equals (REAL + BUS) ÷ NETA
RRSPNA	Equals RRSP ÷ NETA
FINNA	Equals FIN ÷ NETA
MVEHNA	Equals MVEH ÷ NETA
HAGE	Euqals Age of Head of Household
DHAGE	Equals HAGE - 18
MARRIED	Equals '1' if household head is married; otherwise equals zero
PERSONS	Number of Persons Residing in Household
SELF	Equals '1' if household head is self-employed; otherwise equals zero
CHILD	Number of chidlren residing in the household

EDPRF	Equals '1' if either Head or Spouse have a university education and are employed in a managerial or professional occupation
RIMMIG1	Equals '1' if household head immigrated into Canada since 1981; otherwise equals zero
RIMMIG2	Equals '1' if household head immigrated into Canada during 1967-1981; otherwise equals zero
REGION	Geographic regional variables take on the value '1' if the household resides in the region; otherwise equals zero

Table III-3
Summary Statistics for Variables
Used in Regression Analysis
Number of Observations = 771

HOUSE	80427 (44301)	RRSP	3445 (8744)
MORT	29122 (22148)	FIN	7072 (26891)
TLA	7057 (11555)	MVEH	7418 (7080)
LIQ	4065 (3475)	PDEBT	5175 (12788)
NW	83744 (103602)	XDEBT	14267 (20093)
NHNW	19282 (76686)	TA	118041 (108366)
MINMORT	20030 (20997)	NETA	98446 (86010)
XMORT	9092 (14820)	RENA	.063 (.191)
MXMORT	9676 (14195)	BUSNA	.065 (.208)
EARN	40551 (17043)	REBNA	.129 (.279)
NOEARN	1.68 (0.51)	FINNA	.141 (.240)
TXRATE	37.8 (7.4)	MVEHNA	.617 (.382)
PERSONS	3.32 (1.18)	RRSPNA	.113 (.208)
REAL	5013 (25873)	HAGE	32.9 (4.22)
BUS	10600 (64852)	CHILD	1.38 (1.06)

Notes: Means and standard deviations ( ) are provided.

-MINMORT, and is censored from above by the residual collateral value, namely HOUSE - MINMORT. However, there is no clustering of cases around -MINMORT (i.e. MORT = 0). Consequently, given the sample selected, the only censoring of importance is for 'wealthy' households holding MORT = 0 positions who may desire to be short home mortgage debt.

The argument against separating the sample into 'wealthy' and 'nonwealthy' components for demand estimation purposes is that the separation is based on whether i) NHNW > 0 or ii) NHNW = 0. Although NHNW depends upon housing choice as well as household net worth, it is likely that NHNW is primarily driven by net worth.[7] Since net worth is arguably endogenous, separation on net worth introduces a potentially serious selection bias. In order to verify the dominant role of net worth as the separating variable, we estimate a probit function of the likelihood of a household being classified 'wealthy.'

The result of this estimation are reported in Table III-4. The dominant importance of net worth (NW) in determining who is wealthy is confirmed. Net worth would be negative if housing tastes dominated the determination of NHNW, instead of the highly significant positive coefficient we find. The significant negative coefficients on EARN, MARRIED, Ontario and B.C. are consistent with these variables positively affecting the housing demand of young owners (Jones, 1990).

Table III-4 also provides an estimate of the nonhousing wealth position, conditional upon NHNW > 0. We use the two stage 'Heckit' estimation procedure proposed by Heckman (1979) to correct for the sample selection bias that arises from OLS estimation of NHNW on the 'wealthy' subsample. The regressor INDEX represents the inverted Mill's ratio. The high level of significance indicates that there exists a sizeable covariance between the error terms for the discrete and continuous functions. The two stage process frees the estimated parameters of

Table III-4
Probit Estimation of Who is 'Wealthy' and Conditional Estimation of the Amount of Non-Housing Wealth

	(1)	(2)
Dependent	DNHNW	NHNW
NW	.022 (14.4)	.888 (40.4)
EARN	-.014 (3.09)	-1.62 (3.34)
EARNSQ	--	9.28 (2.18)
DHAGE	.103 (1.19)	7273 (1.69)
DHAGESQ	-2.89 (0.97)	244 (1.72)
MARRIED	-.460 (2.06)	--
SELF	.400 (1.15)	-12427 (1.17)
CHILD	.031 (0.49)	726 (0.29)
EDPRF	-.023 (0.18)	631 (0.11)
Maritimes	.297 (1.20)	-3415 (0.32)
Ontario	-.373 (2.48)	-28832 (4.18)
Man-Sask	.232 (1.09)	1765 (0.19)
Alberta	.148 (0.67)	1050 (0.12)
B.C.	-.923 (3.31)	-28064 (2.58)
Index	--	-45654 (7.10)
Constant	-1.88	-95959
Log Likelihood	-494	--
McFadden $\overline{R}^2$	.385	--
$\overline{R}^2$	--	.894
No. Obs.	771	262

Notes: 't' statistics are in ( ). EARNSQ = ((EARN)^2/1000) where EARN is measured in dollars in col(2) and in thousands of dollars in col(3). Similarly, NW is measured in thousands of dollars in col(1) and in dollars in col(2).

sample selectivity bias. Although standard errors also require correction, it is clear that NW is the primary contributor to explaining the variance in 'wealthy' households NHNW.

Given the key role of net worth in separating households into 'wealthy' and 'nonwealthy' classes we report excess debt demand estimates on the combined sample. We test to see whether the results are sensitive to XMORT censoring by estimating the demand function both using OLS and the Tobit censored normal regression model. The Tobit model corrects for selectivity bias resulting from the possibility that some households may wish to hold negative mortgage debt positions but are constrained to zero. To use the Tobit method we have to treat the observed negative XMORT positions of some 'nonwealthy' households as if they were zero holdings. We use the OLS method to provide an estimation of XMORT demand where negative XMORT positions are recognized. Since in all cases the Tobit and OLS estimates are very similar it appears the censoring problems do not, in fact, exert much impact on the estimated parameters.

D. Some Reduced Form Results

The ultimate objective of the empirical exercise is to estimate the demand for 'excess' debt (XDEBT) where XDEBT = XMORT + PDEBT. The focus of our discussion upon the demand for XMORT represents an a priori expectation that XDEBT for homeowners is dominated by XMORT demand. To provide a basis for judging whether this assumption is justified we begin by estimating a total XDEBT function and a PDEBT function. For the 'nonwealthy' estimation of XDEBT is identical to estimating demand for nonhousing assets (NHA).

Nearly all households in the sample (94 percent) hold positive XDEBT positions. Thus, there is little concern about households desiring to short XDEBT. Also XDEBT is not constrained by HOUSE, both because of the sample restrictions summarized above and because the PDEBT portion of XDEBT may be relatively open-ended. Thus, we estimate XDEBT by OLS and provide the results in Table III-5.

The discussion in Chapter I indicated that when measures of total home mortgage debt are used as the dependent variable, household wealth (net worth) usually has a highly significant negative coefficient. This has been taken as evidence that borrowing fulfils a diversification objective; the larger the household's wealth, the less borrowing is required to meet this objective. However, as we observed in Chapter I, this explanation of the negative coefficient cannot be disentangled from the debt minimization objective.

Separating the housing and nonhousing asset demand affects on mortgage demand permits us to achieve the desired separation. We expect nonhousing wealth (NHNW) to have a negative coefficient if XDEBT demand is significantly driven by a diversification motive. However, if risk aversion declines with NHNW, nonhousing wealth may positively affect XDEBT. The evidence from Table III-5 suggests that the latter effect is dominant.

A second test of the diversification hypothesis proposed above is evidence of a linkage between XDEBT demand and financial asset demand. Asset 'tastes' are included as regressors in Table III-5 in the form of selected asset combinations of interest. Assets to the left of 'N' in the variable name are present in the portfolio; those to the right of 'N' are not (read 'N' equals 'not') in the portfolio. The results suggest that XDEBT is significantly driven by the demand for BUS and REAL assets. In addition, the coefficient on FNRB is significantly

Table III-5
Estimation of 'Excess' Debt Demand
Dependent: XDEBT

	(1)	(2)	(3)
RNB	9498 (4.29)		
RB	26578 (7.46)		
BNR	14841 (6.52)		
FNRB		-7891 (5.75)	
MNFRB			-6566 (1.04)
TXRATE	473 (5.34)	340 (3.78)	329 (3.58)
EDPRF	1573 (1.20)	1839 (1.36)	2652 (1.93)
CHILD	-1846 (3.02)	-1363 (2.17)	-1596 (2.49)
DHAGE	481 (0.55)	500 (0.55)	1038 (1.13)
DHAGESQ	-22.8 (0.74)	-24.1 (0.76)	-39.6 (1.23)
NHNW	.121 (5.96)	.180 (9.29)	.204 (10.5)
NHNWSQ	-.087 (3.45)	-.133 (5.27)	-.156 (6.16)
CONSTANT	-8412	1058	-5885
$\overline{R}^2$	.296	.249	.218
No. Obs.	771	771	771

Notes: 't' statistics are in ( ). NHNWSQ = $(NHNW/1000)^2$

negative, corroborating the positive sign on NHNW and indicating that, contrary to previous studies, including Jones (1986), the diversification motive does not provide the explanation for debt demand.

The strong positive significance of the TXRATE variable is interesting. This result is contrary to the usual assumption that the cost of home mortgage and personal debt is unaffected by household tax positions in the Canadian tax environment. Of course, the TXRATE variable is a combination of household income, sociodemographic attributes and place of residence. Therefore, we have estimated XDEBT specifications (and XMORT functions) without TXRATE and with income and attribute variables. Coefficients on income variables are sensitive to the income measure used but in most cases coefficients are insignificant. Therefore, we tentatively conclude that the particular nonlinear combination of variables represented by TXRATE does represent a proxy for the household specific after tax cost of debt.

Attribute variables are included separately in the estimations as proxies for household risk aversion to leverage. Excepting NHNW, the only household characteristic which is often significant in explaining excess debt demand is the number of children residing in the household (CHILD). As expected CHILD has a negative coefficient. The education-occupation variable is positive as expected with 't' statistics that are greater than unity, but generally not significant by conventional criteria. For this young (under age 40) sample, age of the household head is positive, as expected, but insignificant. All other attribute variables included as regressors had 't' statistics less than unity and were deleted in the final estimations. When XDEBT is estimated separately for the 'wealthy' (NHNW > 0) and 'nonwealthy' (NHNW = 0), the results are very

similar to the combined sample results. The only difference in coefficient significance levels is that EDPRF is positive and highly significant in the 'nonwealthy' estimation.

As indicated above, we also experimented with estimations of a PDEBT function. However, we could not find a specification that provided either much explanatory value or significant coefficients. The only regressor which is consistently significant (and positive) in explaining PDEBT is MVEHNA, the share of the nonhousing assets made up of motor vehicles (as a proxy for consumer durables). This suggests that in the sample at large, PDEBT and XMORT are largely segmented in their financing roles.

A further test of this hypothesis is provided by estimating XMORT demand functions similar to the XDEBT specifications. Results of such estimations are reported in Tables III-6, III-7 and III-8. Tables III-6 and III-7 are estimated on identical specifications with Table III-6 reporting the Tobit results and Table III-7 the OLS results. The two estimation methods produce very similar results.

The ASSET vector is entered in these two sets of regressions as the share of each asset cohort in their sum, which is total nonhousing assets (NHA). A separate equation is estimated for each cohort share. Because of the relationship between asset tastes and NHNW found in Table III-1, NHNW is deleted as a regressor when the asset 'taste' variables are entered.[8] Once again, it appears that excess debt demand is strongly positively associated with a 'taste' for REAL and BUS assets, and XMORT demand is strongly negatively associated with the importance of consumer durables (as represented by MVEHNA) in the portfolio. The coefficients on FINNA and RRSPNA are also positive and significant at the five percent level; however, the coefficients are quite small in relation to BUSNA and RENA.[9]

Table III-6
Tobit Excess Mortgage Demand
Reduced Form Estimations on Asset Shares
Dependent: MXMORT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NHNW	.051 (5.90)						
REBNA		28112 (12.8)					
RENA			23075 (6.86)				
BUSNA				30894 (10.2)			
FINNA					5392 (1.90)		
RRSPNA						5965 (1.86)	
MVEHNA							-19738 (11.8)
TXRATE	271 (2.84)	414 (4.84)	344(3.63)	415 (4.59)	318 (3.22)	331 (3.36)	296 (3.45)
EDPRF	4381 (3.20)	3323 (2.71)	3839 (2.82)	4377 (3.38)	4525 (3.20)	4539 (3.20)	2430 (1.94)
CHILD	-1416 (2.29)	-1349 (2.44)	-983 (1.61)	-1571 (2.68)	-1050 (1.65)	-1099 (1.72)	-847 (1.51)
PDEBT	-.055 (1.00)	-.059 (1.17)	.006 (0.12)	-.038 (0.74)	.020 (0.36)	.034 (0.62)	-.032 (0.66)
Alberta	5515 (2.52)	5349 (2.74)	5688 (2.62)	6265 (3.04)	6318 (2.80)	6454 (2.86)	5199 (2.62)
B.C.	7289 (2.96)	7031 (3.20)	8274 (3.39)	7062 (3.04)	8295 (3.27)	8399 (3.31)	7106 (3.18)
Constant	-5787	-13156	-9818	-12060	-8562	-9017	6602
Log Likelihood	-6228	-6164	-6222	-6193	-6243	-6243	-6175
R^2	.132	.309	.142	.229	.077	.075	.283
No. Obs.	771	771	771	771	771	771	771

Note: Asymptotic 't' statistics are in ( )

Table III-7
OLS Excess Mortgage Demand
Reduced Form Estimations on Asset Shares
Dependent: XMORT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NHNW	.054 (7.86)						
REBNA		25797 (15.8)					
RENA			21238 (8.09)				
BUSNA				28253 (12.2)			
FINNA					6801 (3.13)		
RRSPNA						5435 (2.18)	
MVEHNA							-18288 (15.1)
TXRATE	171 (2.37)	305 (4.70)	233 (3.25)	305 (4.46)	206 (2.77)	221 (2.97)	204 (3.12)
EDPRF	3958 (3.74)	3067 (3.20)	3510 (3.31)	4030 (4.01)	4076 (3.72)	4177 (3.80)	2269 (2.33)
CHILD	-875 (1.85)	-838 (1.97)	-504 (1.07)	-982 (2.19)	-503 (1.03)	-556 (1.14)	-389 (0.90)
PDEBT	-.039 (0.97)	-.029 (0.81)	.024 (0.60)	-.012 (0.31)	.032 (0.77)	.048 (1.17)	-.016 (0.43)
Alberta	4828 (2.85)	4688 (3.07)	4995 (2.96)	5543 (3.15)	5563 (3.19)	5704 (3.26)	4567 (2.96)
B.C.	5849 (3.03)	5748 (3.31)	6821 (3.55)	5757 (3.15)	6812 (3.43)	6909 (3.47)	5809 (3.31)
Constant	494	-6594	-2902	-5496	-1832	-2129	11479
$\bar{R}^2$	.131	.292	.135	.215	.072	.066	.276
No. Obs.	771	771	771	771	771	771	771

Note: 't' statistics are in ( ).

Table III-8
Tobit and OLS Excess Mortgage Demand
Reduced Form Estimations on Asset Combinations

	(1)	(2)	(3)	(4)
RNB	12113 (5.93)		11014 (6.90)	
RB	31296 (9.96)		28763 (11.8)	
BNR	19079 (9.30)		17414 (11.0)	
FNRB		-21030 (12.3)		-18587 (14.8)
MNFRBP		-14545 (9.23)		-13435 (11.2)
TXRATE	352 (4.18)	309 (3.61)	253 (3.92)	211 (3.21)
EDPRF	3097 (2.50)	2750 (2.17)	2729 (2.82)	2440 (2.46)
CHILD	-1834 (3.12)	-1317 (2.21)	-1496 (3.31)	-1041 (2.27)
DHAGE	-5.56 (0.01)	-478 (0.56)	268 (0.41)	-88.3 (0.13)
DHAGESQ	0.70 (0.02)	16.1 (0.54)	-3.42 (0.15)	8.33 (0.36)
CONSTANT	-9688	12122	-6338	13090
Log Likelihood	-6166	-6175		
R^2	.309	.274		
$\overline{R}^2$			.291	.262
No. Obs.	771	771	771	771

Notes: Columns (1) and (2) are Tobit estimation with asymptotic 't' statistics in ( ). Columns (3) and (4) are OLS estimates with 't' statistics in ( ). The dependent variable in the Tobit estimations is MXMORT and in the OLS estimations is XMORT.

PDEBT is insignificant in Tables III-6 and III-7. These results corroborate the view that PDEBT and XMORT have largely segmented roles in financing nonhousing assets. Otherwise, the primary difference in these results from those found by estimating XDEBT demand is that EDPRF is significant and the Alberta and B.C. dummies are positive and significant. TXRATE is consistently positive and significant. All other attribute variables had 't' statistics less than unity and were deleted from these estimations.

Finally, Table III-8 provides results from reduced form Tobit and OLS estimations with the ASSET vector entered in the same form as in the XDEBT specification. The five asset cohorts represented in Table III-8 account for virtually all (98.9%) of household nonhousing assets. The Tobit and OLS results are very similar and the OLS results are very similar to the XDEBT results, excepting for the role of PDEBT in financing consumer durables. Thus, it does appear that the demand for XDEBT is dominated by the demand for XMORT.

E. Results Based on Endogenizing Asset Tastes

The reduced form estimates reported above are based upon an assumption that optimal excess debt demand is determined each period based upon housing demand, nonhousing wealth and asset tastes having been predetermined. Given the high transactions costs associated with owning a principal residence, it is credible to assume predetermined housing demand when estimating mortgage demand on cross-section data. However, similar assumptions with respect to nonhousing wealth and asset tastes are problematical.

First, desired life cycle savings is likely affected by willingness to use borrowing for the purpose of fulfilling portfolio objectives. Second, we found above that NHNW levels positively

affect the demand for XDEBT and for XMORT; we surmise that their effect derives from an inverse relation between risk aversion (to leverage) and wealth. Third, this wealth effect must operate through the formation of asset tastes; these tastes are likely affected by the same attitudes toward risk that affect the willingness to borrowing on one's home to acquire risky nonhousing assets. Finally, household attributes, such as TXRATE, that affect the cost of debt may also affect after tax returns expected to be realized from investment in risky assets. The reduced form estimates do not recognize these potential choice mechanisms; consequently, the coefficients on the asset share (combination) variables and TXRATE, in particular, may be biased.

Therefore, we re-estimate the excess mortgage debt function by endogenizing asset tastes. In the first part of Section E we do so by estimating the likelihood of holding particular asset combinations on household attributes, including measured NHNW. In the second part, the asset likelihood estimates are based on partial endogenization of NHNW. Following the estimates of NHNW above (Table III-4), which suggested that NHNW is largely driven by NW, we estimate a wealth (NW) function and use the estimated NW results in calculating NHNW.

1. First Stage Endogenization of Asset Tastes

In order to endogenize asset tastes we estimate probit functions of the likelihood of households holding specific asset combinations included in the reduced form estimations in Table III-7. The regressors are household nonhousing wealth, labor earnings (EARN) and a variety

of sociodemographic, education and occupation proxies. The results of these estimations are reported in Table III-9.

As expected, nonhousing wealth has a strongly significant positive effect on the likelihood that households own illiquid investments in the form of REAL or BUS assets. Earnings from human capital have an insignificant impact on the likelihood of holding BUS or REAL (so is deleted as a variable from these estimates), but appear to have some impact on choices of portfolios from the menu of options that do not contain REAL or BUS. Various attribute variables including, in particular, age, occupation and education, have significant impacts on tastes for some portfolio combinations.

In Table III-10 we use the predicted probabilities from the probit 'taste' estimations as predictors in estimating XMORT demand functions. The 'E' at the beginning of the variable name for the asset taste variables, indicates the variable represents estimated probabilities. We report both Tobit and OLS results. The results only partially confirm the hypothesis that XMORT demand derives primarily from the taste for REAL and BUS assets. The coefficient on portfolios containing both REAL and BUS is positive and significant, but extraordinarily large. The coefficient on REB is of more credible magnitude and still highly significant. However, the reduced form estimates for RNB and BNR are not corroborated when their predicted probabilities are used as regressors.

The variable EFNRB has a large negative, and significant, coefficient as expected but surprisingly, a strong taste for consumer durables (EMNFRB) has no significant impact on

Table III-9
Probit Estimations of Tastes for Real Estate and Business Assets

Dependent	(1) REB	(2) RNB	(3) RB	(4) BNR	(5) FNRB	(6) MNFRB
DNHNW	1.13 (9.86)					
NHNW		.010 (4.31)	.007 (3.95)	.003 (4.27)	-.023 (6.27)	-.004 (2.92)
NHNWSQ		-.019 (3.08)	-.006 (2.46)		.000 (5.39)	
DHAGE	.265 (2.53)	.401 (2.73)	.238 (0.99)		-.141 (2.04)	
DHAGESQ	-.009 (2.54)	-0.14 (2.78)	-.007 (0.91)		.004 (1.76)	
DSELF	1.76 (5.20)		.812 (2.53)	1.73 (6.71)	-.808 (2.01)	-1.30 (2.67)
EDPRF	.221 (1.93)	.318 (2.38)	.163 (0.84)		-.175 (1.61)	
NOEARN				.292 (2.05)		
MARRIED	.145 (0.69)					-.266 (1.39)
PERSONS			.128 (1.51)			
CHILD				.095 (1.47)		.001 (0.02)
EARN					-.031 (2.41)	.043 (3.58)
EARNSQ					.199 (1.49)	-.323 (2.73)
CONSTANT	-3.37	-4.37	-4.52	-2.18	1.45	-1.04
Log Likelihood	-405	-235	-120	-237	-503	-522
McFadden $\bar{R}^2$	.209	.078	.195	.153	.117	.047
No. Obs.	771	771	771	771	771	771

Notes: NHNW and EARN are measured in thousands of dollars. EARNSQ = $(EARN)^2/1000$. Asymptotic 't' statistics are in ( ). REB is a dummy variable that takes the value '1' if R+B>0 and the value '0' if R+B=0. DNHNW is a dummy variable that takes on the value '1' if NHNW>0 and is otherwise equal to zero.

Table III-10
Estimated Excess Mortgage Demand
Results Using Endogenized Asset Tastes

	(1)	(2)	(3)	(4)	(5)	(6)
ERNB	-21707 (1.67)			-2024 (0.20)		
ERB	74448 (4.57)			64882 (5.08)		
EBNR	4618 (0.53)			4089 (0.61)		
EDREB		14554 (4.09)			21635 (8.21)	
EFNRB			-28049 (5.30)			-31087 (7.91)
EMNFRB			-4365 (0.71)			-6829 (1.45)
TXRATE	236 (2.46)	287 (2.95)	164 (1.55)	141 (1.92)	217 (2.97)	73.7 (0.91)
EDPRF	4476 (2.97)	3664 (2.57)	2043 (1.37)	3028 (2.60)	2491 (2.28)	1133 (0.99)
CHILD	-2441 (3.69)	-1637 (2.47)	-1176 (1.74)	-1930 (3.83)	-1281 (2.56)	-793 (1.54)
DHAGE	1341 (1.31)	-27.2 (0.03)	-1155 (1.14)	880 (1.11)	-161 (0.22)	-1099 (1.42)
DHAGESQ	-46.1 (1.28)	4.42 (0.13)	34.6 (1.00)	-25.0 (0.90)	11.7 (0.46)	35.8 (1.35)
PDEBT	-.064 (1.13)	.001 (1.13)	-.033 (0.61)	-.041 (1.00)	.008 (0.19)	-.026 (0.63)
CONSTANT	-11002	-7791	21679	-4246	-3584	28848
Log Likelihood	-6223	-6244	-6236			
R^2	.149	.116	.130			
$\overline{R}^2$				.143	.123	.133
No. Obs.	771	771	771	771	771	771

Notes: Columns (1), (2) and (3) are Tobit estimations with MXMORT as the dependent variable and with asymptotic 't' statistics in the ( ). Columns (3), (4) and (6) are OLS estimation with XMORT as the dependent variable and with 't' statistics in the ( ).

XMORT demand although a sizeable negative effect is expected. The household attribute variables have very similar effects to those found in the reduced form estimates. As hypothesized, TXRATE is significant when predicted probabilities for tax shelter REAL or BUS investments are included as regressors. As before, there is no indication that XMORT and PDEBT are significantly substitutes in the financing of nonhousing portfolios.

2. Estimating Asset Tastes on Endogenized Wealth

In this section we re-estimate the probit likelihood of households holding specific asset combinations by substituting estimated NHNW for measured NHNW. The nonhousing wealth estimate is obtained from estimating a total wealth (net worth) function. The results of this estimation are reported in Table III-11 where the dependent variable is the natural logarithm of household net worth.

These results indicate that household wealth is strongly influenced by the earning capacity and quality of human capital as measured by the EARN, DSELF and EDPRF variables. The positive impact of recent immigration may reflect the role of wealth and entrepreneurial abilities in Canadian government immigrant policies. Household life cycle attributes appear to matter; in particular, households are successful in accumulating wealth over time as the strong positive impact of the head's age indicates. Also, the provinces with stronger economies do appear to produce (or attract) wealthier households.

There is no data in the Canadian SCF surveys that allows estimation of the contribution of inherited wealth, gifts or other windfalls on household wealth, although, as Jones (1990) suggests these events are likely to be important in explaining the distribution of wealth among

Table 11
Estimation of Household Net Worth
Dependent: LnNW

EARN	.015 (8.32)
DSELF	.717 (4.99)
EDPRF	.114 (1.98)
NOEARN	-.121 (2.08)
MARRIED	.109 (1.03)
DHAGE	.046 (7.11)
RIMM1G1	1.17 (2.25)
RIMM1G2	.152 (1.79)
Maritimes	.088 (0.74)
Ontario	.202 (2.95)
Man-Sask	.153 (1.56)
Alberta	.268 (2.66)
B.C.	.489 (4.34)
Constant	9.50
$\overline{R}^2$	.247
No. Obs.	771

Notes: EARN is measured in thousands of dollars. 't' statistics are in ( ).

young households. In Chapter IV we provide some evidence of the impact of such exogenous contributions to household wealth for U.S. households.

The total wealth estimates are used to estimate nonhousing wealth as follows. We base the estimate of NHNW on the finding above that housing demand plays a distinctly secondary role in determining NHNW, and take housing demand in the form of HOUSE + LIQ as predetermined. For each household, we take the antilog of the predicted values from the regression in Table III-11 and label the result ENW. Then we compute ENHNW = ENW - HOUSE - LIQ. Since, by construction, NHNW is nonnegative we define estimated nonhousing wealth (ESNHNW) as follows:

$$ESNHNW = \begin{cases} 0 \text{ if } ENHNW \leq 0 \\ ENHNW \text{ if } ENHNW > 0 \end{cases}$$

We then re-estimate the probit asset taste functions substituting ESNHNW for measured NHNW and report the results in Table III-12.

In contrast to the probit estimates based on NHNW, the Table III-12 results indicate that nonhousing wealth has little explanatory value. This may occur because asset 'tastes' affect household savings rather than wealth determining tastes. However, the result could be produced by a faulty estimation of net worth due to missing data on critical explanatory factors. The probit estimates of asset 'tastes' based on ESNHNW do possess less explanatory value that the earlier probit estimates based on measured NHNW.

Table III-12
Probit Estimations of Tastes for Specific Assets
Using Endogenized Wealth

	(1)	(2)	(3)	(4)	(5)	(6)
	RNB	RB	BNR	REB	FNRB	MNFRBP
ESNHNW	-.003 (0.74)	.006 (1.67)	-.003 (0.94)	.004 (1.01)	.002 (0.50)	.002 (0.50)
EDPRF	.354 (2.71)	.164 (0.88)		.226 (2.10)	-.189 (1.80)	.002 (0.02)
DHAGE	.399 (2.81)	.284 (1.23)		.307 (3.05)	-.174 (2.56)	.020 (0.30)
DHAGESQ	-.013 (2.77)	-.008 (1.12)		-.010 (2.86)	.005 (2.13)	-.000 (0.07)
DSELF		.765 (2.14)	1.96 (6.58)	1.81 (5.38)	-1.03 (2.76)	-1.51 (2.95)
NOE			.221 (1.61)	.028 (0.26)		-.114 (1.14)
EARN					-.020 (4.54)	.045 (3.56)
EARNSQ						-.379 (3.03)
PERSONS		.123 (1.51)				
CHILD			.107 (1.69)		.028 (0.54)	-.054 (1.14)
MARRIED					.364 (1.86)	
TXRATE					.016 (1.88)	
CONSTANT	-4.34	-4.74	-1.98	-3.28	.909	-1.30
Log Likelihood	-235	-120	-237	-405	-503	-522
McFadden $\bar{R}^2$	.037	.108	.115	.084	.054	.030
No. Obs.	771	771	771	771	771	771

Notes: ESNHNW and EARN are measured in thousands of dollars. EARNSQ = ((EARN)^2/1000). Asymptotic 't' statistics are in the ( ).

We obtain some sense of the credibility of the probit taste estimates in Table III-12 by using the predicted probabilities of these asset variables as regressors in the estimation of XMORT. The results from these Tobit and OLS estimations are reported in Table III-13. The 'ES' at the beginning of the asset taste variable names indicate the variables are the predicted probabilities from the Table III-12 parameters. These estimations do provide further corroboration of the proposition that XMORT demand is significantly derived from the demand for REAL and BUS assets. Only the BNR cohort coefficient does not confirm this hypothesis. There continues to be evidence of a strong TXRATE impact, which we interpret as a proxy for the household specific after tax cost of mortgage debt.

F. Summary and Conclusions

The objective of Chapter III has been to provide a methodology for estimating demand for home mortgage debt that is responsive to the critiques of previous approaches reviewed in Chapter I. We concluded in Chapter I that wealth, income, asset demand and household attribute effects on mortgage demand are difficult to discern without separating the housing and nonhousing demand effects on debt financing.

In particular, the existing literature appears to confirm a belief that nonhousing driven debt demand is dominated by a diversification motive. The empirical basis for this belief is a strong negative relationship between mortgage demand and household wealth (net worth). An important issue is whether this finding is confirmed when the effect of housing and nonhousing demands are distinguished.

Table III-13
Estimated Excess Mortgage Demand
Using Asset Tastes with Endogenized Wealth

	(1)	(2)	(3)	(4)	(5)	(6)
ESRNB	49811 (2.45)	41478 (2.63)				
ESRB	79837 (4.81)	75398 (5.78)				
ESBNR	-1583 (0.20)	-1718 (0.28)				
ESREB			24570 (4.61)	22394 (5.45)		
ESFNRB					-34189 (6.62)	-30265 (8.09)
ESMNFRB					-8178 (1.14)	-8741 (1.64)
TXRATE	267 (2.70)	160 (2.13)	359 (3.73)	243 (3.33)	261 (2.46)	170 (2.18)
CHILD	-2408 (3.57)	-1998 (3.88)	-1790 (2.66)	-1374 (2.68)	-1224 (1.90)	-643 (1.37)
DHAGE	-1463 (1.15)	-869 (0.88)	-335 (0.33)	7.23 (0.01)		
DHAGESQ	49.7 (1.14)	34.5 (1.02)		6.33 (0.24)		
PDEBT	.004 (0.72)	.026 (0.63)	.007 (0.12)	.028 (0.69)	-.005 (0.09)	.061 (1.57)
CONSTANT	1849	3971	-8621	-4917	13531	18296
Log Likelihood	-6239		-6248		-6238	
R^2	.099		.075		.107	
$\overline{R}^2$		.091		.065		.098
No. Obs.	771	771	771	771	771	771

Notes: Columns (1), (3) and (5) are Tobit estimations using MXMORT as the dependent variable and with asymptotic 't' statistics in the ( ). Columns (2), (4) and (6) are OLS estimates with XMORT as the dependent variable and with 't' statistics in the ( ).

Finally, single equation estimation assumes household asset tastes and wealth are exogenous or predetermined. However, household wealth is produced, in significant part, from exploitation of household attributes, and the asset 'tastes' that trigger debt demand are likely functionally derived from household wealth and the attributes that determine the degree of household risk aversion. Failure to take these channels into account may result in substantial coefficient bias.

The debt demand estimation methods used in this Chapter are designed to respond to these critiques. We use the separation theorem developed in Chapter II to distinguish the component of debt demand derived from the demand for nonhousing assets. We specify the assumptions required to show how the household's optimal portfolio at any point in time in its life cycle can be reduced to treating the household as choosing the magnitude and composition of its nonhousing asset portfolio as if it is optimizing over the mean and variance of the portfolio, given the nonhousing wealth endowment. In estimating the determinants of 'excess' debt demand, that is the portion derived from the demand for nonhousing assets, we initially estimate a single equation reduced form function. However, we then test the validity of these results by endogenizing household wealth and asset 'tastes' as a function of estimated wealth.

From these estimates, we conclude that there is little, if any, diversification motive affecting excess debt demand. Nor does excess mortgage demand appear to be used to finance consumer durables. Rather, the results indicate that home mortgage debt positions are primarily used to finance assets with tax shelter characteristics and assets which complement human capital skills possessed by household members. These conclusions are suggested from the positive impact of business assets, nonhousing real estate investments and the household's marginal

income tax rate on excess debt demand. Finally, it appears that home mortgage debt and personal debt play largely separable financing roles in fulfilling household objectives.

Footnotes to Chapter III

[1] Throughout the rest of the study, the factor α is defined as min ($TLA/P_H H$; .10) where TLA equals the household's liquid asset position.

[2] See, for example, Firstenberg, Ross and Zisler (1988) and Webb, Curcio and Rubens (1989).

[3] To the extent interest is deductible this implies there is a discontinuity in the after tax cost of home mortgage debt which occurs at the next dollar borrowed beyond $M^*(h^*)$ (the minimum debt needed to own the housing unit chosen).

[4] We can identify the highest income member of a household from the 1984 SCF only when the head, or spouse, has over half of the household's total income. It is therefore necessary to delete from the sample households who do not meet this criterion. We are able to account for dependents and single parent status in determining deductions for these purposes. We know whether the individual in question is covered by a pension plan and whether they have an RRSP account. Contingent on that information we assume the individual makes the largest RRSP contributions for which they are eligible. Similarly, if the member has an RHOSP account we assume they make the full $1000 contribution allowed. We also assume the household takes the Canadian source interest and dividend deductions, contingent on their sources of income, up to the maximum

allowed. The tax schedule for the Province of residence is applied to the member's taxable income to determine the individual's marginal tax rate. Since each Province is not separately identified in SCF84 we use the Manitoba tax schedule for residents of Manitoba and Saskatchewan and the Nova Scotia tax schedule for all residents of the Maritimes. The Quebec tax code was used to estimate federal and provincial taxes and the tax rate at the margin for residents of Quebec.

[5] We approximate mortgage payments as .14 (MORT) where MORT is the outstanding home mortgage loan balance and .14 is the approximate mortgage rate at the time of the survey.

[6] Given the sample selection criterion reported in footnote (2), MORT is empirically limited to .8HOUSE. However, the purpose of the sample restriction is to select households who have unused borrowing capacity; thus all households in the sample are viewed as having chosen MORT < .8HOUSE.

[7] Current net worth also plays a major role in determining the housing demand of young Canadian owner-occupiers. However, the net worth elasticity appears to be substantially less than unity; estimates reported in Jones (1990) place this elasticity in the .3 to .5 range. Thus, net worth is expected to have a significantly positive impact on NHNW.

8 Including NHNW and NHNWSQ as regressors along with asset 'taste' variables has little impact on the coefficients or significance levels of the latter. However, the coefficients and 't' statistics on NHNW and NHNWSQ are dramatically reduced when the asset 'taste' variables are added as explanatory variables.

9 We have also estimated XMORT functions in this form separately for the 'wealthy' and 'nonwealthy' cohorts and, for each, the subset of households who do not hold REAL or BUS assets. Both these selection devices produce results that may be contaminated by sample selection bias. For the first separation, the primary difference is that FINNA and RRSPNA have negative (though insignificant) coefficients when the estimation is performed on 'wealthy' households and positive and significant coefficients for the 'nonwealthy' sample. Also TXRATE is not consistently significant in the 'nonwealthy' sample estimation.

When the estimation is performed on households who do not hold either REAL or BUS assets the coefficients on FINNA and RRSPNA are positive and significant for both 'wealthy' and 'nonwealthy.' The coefficient on MVEHNA remains significantly negative. This result suggests that the diversification motive may be affecting the demand for XMORT for this subsample. However, as seen above (Chapter II) the magnitude of XMORT demand for this subsample is quite modest.

CHAPTER IV

EXCESS MORTGAGE DEMAND ESTIMATION FOR U.S. HOUSEHOLDS

In this chapter we estimate the magnitude of excess mortgage debt positions of households resident in the United States and provide the results of estimates of determinants of the demand for excess mortgage debt. We follow the estimation procedures applied to Canadian data as closely as possible in order to be able to make valid comparison between U.S. and Canadian household behavior. To ensure we are making behavioral comparisons at about the same point in time we perform the U.S. estimations on the 1983 U.S. Survey of Consumer Finances. This household survey was conducted within the year prior to the 1984 Statistics Canada Survey of Consumer Finances used in Chapters II and III.

The U.S. SCF is structured in a similar manner to the Canadian SCF. The special strength of both surveys for our purpose is the detailed data on household balance sheets. Although the U.S. sample size is substantially smaller than its Canadian counterpart, it contains much more detail on household mortgage debt, including data essential to estimation of households' perception of the market value of their mortgage debt. It also contains data on inherited wealth and other wealth windfalls and on household attitudes toward liquidity, investment risk and the uses of credit which prove useful augments to the basic household attribute data available in both surveys.

In Section A we estimate the proportion of households holding positive excess demand positions and the relative magnitude of excess debt holdings. Interest on home mortgage debt was deductible in full in computing taxable income in the United States in 1983, regardless of the use of home mortgage financing. Consequently, we cannot be confident that, given the certainty model's assumptions (Chapter II), the minimum debt required to hold the chosen house is also the optimal debt. However, the decomposition rule separating mortgage demand derived from housing demand from the portion derived from demand for nonhousing assets, remains valid. Thus, we sort households into 'wealthy' and 'nonwealthy' cohorts, and these cohorts into three excess mortgage debt positions, and compare these findings with the results found in Chapter II for Canadian households.

In the remainder of this chapter we replicate the principal estimations of the determinants of excess mortgage demand reported in Chapter III, on the U.S. SCF data base. Section B reviews differences in the variables that affect the demand function specification and provides variable definitions, summary statistics, and an overview of the composition of U.S. household nonhousing portfolios. The reduced form excess mortgage demand estimation results are reported in Section C. In Section D, household wealth and asset tastes are endogenized in a manner comparable to that used in Chapter II and the results reported for demand estimates using endogenized asset tastes as regressors. Section E provides direct U.S. and Canadian comparisons for the young (under age 40) cohort. The Chapter concludes in Section F with a brief summary of the Chapter's conclusions.

A. Estimating the Incidence and Magnitude of Excess Mortgage Demand

We estimate excess mortgage debt positions using the decomposition rule generated by the mortgage demand model formulated in Chapter II. Thus the demand for mortgage debt derived from housing demand (M(h)) is defined as

$$(1) \qquad M(h) = \begin{cases} 0 \text{ if } (P_H H + L(H)) \geq NW \\ P_H H + L(H) - NW \text{ if } NW > (P_H H + L(H)) \end{cases}$$

where L(H) is the housing generated liquidity demand, $P_H H$ the market value of the owner-occupied residence and NW is the household's net worth. In the empirical estimates of excess mortgage debt (XMORT) incidence presented in Table IV-1, we define L(H) as in Chapter III, namely

$$(2) \qquad L(H) = \min(TLA;\ .1P_H H)$$

where TLA = a household's total liquid asset holdings. Also, as before,

$$(3) \qquad XMORT = MORT - M(h)$$

where MORT is the value of all mortgage debt secured by the principal residence.

Underlying the estimate of XMORT is the maintained hypothesis that observed households are in equilibrium with regard to their mortgage debt positions. Also, the household choice decision process is based upon a valuation of mortgage liabilities that represents what market values would be if the market possessed all the household's privately held information regarding refinancing and moving probabilities. In the Canadian case, we relied upon the

knowledge that mortgagors under the age of forty had only operated in an environment of short term 'rollover' loans. Selecting this subsample of young households ensured that mortgage positions were frequently reassessed and that book values were reasonable proxies for market values.

In the United States, a sizeable proportion of home mortgage loans have continued to include long terms of 30 years or more. Green and Shoven (1986) have shown that, as a result, households with seasoned loan contract rates well below current market rates tend to be 'locked in' to their homes. That is, households in this position are significantly less likely, ceteris paribus, to move. Such households may therefore be in housing disequilibrium so long as loans can only be prepaid at book value. However, given their house, they need not be in mortgage debt disequilibrium, although observed mortgage balances will exaggerate households' perceptions of the market value of their home mortgage debt.

On the other hand, U.S. loans typically either do not contain prepayment restrictions or penalties or include provisions calling for quite modest prepayment penalties operative only in the early period of the loan contract. Consequently, for most U.S. households, the transactions costs of refinancing are essentially limited to the costs of acquiring a replacement loan, if such a loan is desired. Therefore, mortgage pricing models in the U.S. have focused upon modelling the exercise of the borrower call option and this exercise is assumed to turn largely on market interest rate movements (Hendershott and Van Order, 1987).

The 1983 U.S. SCF contains interest rate, term and payment data for the two largest home mortgage loans held by a household. Based upon the Green and Shoven (1986) 'lock in' findings we estimate the market value for loans with low 'contract' rates by discounting the

remaining payments to term by an approximation of the current mortgage rate. At the time of the 1983 survey, first mortgages on homes were being made at about 13% per annum (compounded monthly) and we assume, for this calculation, that the going second mortgage rate was about 15%. Due to data quality concerns, we restrict observations to amortized loans with level monthly payments. Market values are estimated in this fashion for all first mortgages with contract rates less than 13% and for all second mortgages containing contract rates less than 15%. In order to perform these calculations we restrict the sample to households with no more than two home mortgage loans.

For first (second) mortgage loans with contract rates in excess of 13% (15%), we assume that low cost prepayment acts to cap the households' subjective market value of home mortgage debt at book value (balance outstanding). We also value Variable Rate Mortgages at book value; for most VRM this should be a reasonable approximation. In any case, no information is provided on the rate adjustment formula which would allow for a computation of a better estimate of book value.

With these mortgage values we calculate household net worth (NW) in (1) above by using the market value of mortgage debt (MVMORT) in the valuation of household liabilities. In addition, XMORT in (3) is calculated as

(3a) $XMORT = MVMORT - M(h)$

For purposes of computing XMORT positions we restrict the sample to spending units consisting of a nuclear family with an employed head residing in a large urban area. These restrictions are comparable to those used in Chapter II and serve the same purposes of ensuring (respectively)

that the spending unit is a single decision unit (household), is financially capable of recontracting their mortgage loans and can be regarded as operating in a national mortgage market.

Because the U.S. SCF provides the mortgage terms that allow us to estimate market values, we need not restrict the sample to young households. Thus, column (1) of Table IV-1 provides the distribution of households of all ages according to whether they possess i) positive ii) negative or iii) zero XMORT positions. In order to compare the U.S. distribution with that found for Canada, the second column of Table IV-1 provides the distribution for households with heads and spouses (where present) under the age of forty. The comparable Canadian distribution is shown in column (3). Households are weighted by their sample weights in computing the distributions.

The primary difference between columns (1) and (2) in Table IV-1 is that nearly 62 percent of the full sample are 'wealthy' as compared to just over 40 percent of the 'under forty' households, and a larger proportion of the 'wealthy' of all ages have elected to minimize mortgage debt. However, the proportion of all households in each sample holding positive excess debt is about the same.

Our priors are that a higher proportion of U.S. than Canadian households should be expected to hold positive excess debt in the U.S. than in Canada. These priors are based on the knowledge that U.S. households can fully deduct home mortgage interest for tax purposes. We have observed above that, in principle, Canadians should be able to fully deduct interest on excess mortgage debt balances. However, for Canadians to achieve this potential they must incur transactions or interest costs associated with frequent refinancing or junior mortgage loans. This need, of course, results from the fact that M(h) changes as NW changes and that

Table IV-1
Distribution of Households By Mortgage Demand Cohorts

	(1) U.S. All Ages	(2) U.S. Under 40	(3) Canadian Under 40
I XMORT = 0			
A. Wealthy: M = 0	25.7%	13.4%	13.6%
B. Nonwealthy: XM = 0	1.9	2.3	4.5
II XMORT < 0			
C. Nonwealthy: M = 0	2.8	4.8	1.2
D. Nonwealthy: XM < 0	4.9	6.6	7.2
III XMORT > 0			
E. Wealthy: M > 0	36.2	26.8	20.6
F. Nonwealthy: XM > 0	28.4	46.2	52.8
Total	100.0	100.0	100.0
Number of Observations	1071	389	1050

Notes:

1) M = MVMORT; XM = XMORT; a household is 'wealthy' if NW $\geq (1 + \alpha) P_H H$ and is 'nonwealthy' if NW $< (1 + \alpha) P_H H$ where $\alpha = \min(TLA/P_H H; .1)$, TLA = Total Liquid Assets, $P_H H$ = market value of house and NW = net worth (based on MVMORT as the measure of mortgage debt liability). Full definitions of MVMORT, XMORT, TLA and NW are provided below in Table IV-2.

2) Full cohort definitions are:

A. $W > (1 + \alpha) P_H H$, $M = 0$
B. $M > 0$, $M > (P_H H - NW)$, $M \leq [(! + \alpha) P_H H - NW]$
C. $M = 0$, $NW \leq [(1 + \alpha) P_H H]$
D. $XM < 0$, $M > 0$, $M \leq (P_H H - NW)$
E. $M > 0$, $NW > [(1 + \alpha) P_H H - NW]$
F. $M > 0$, $XM > 0$, $NW \leq [(1 + \alpha) P_H H]$

3) Column (3) is reproduced from column (3) of Table III-1.

households must link debt financing to eligible investments in a manner that is persuasive to Revenue Canada.

Therefore, it is somewhat surprising to find (Table IV-1) that the proportion of young households with positive XMORT is virtually identical (73 percent) for Americans and Canadians. The share of XMORT in MVMORT is somewhat higher for U.S. households (42.2%) than for Canadians (34.1%). In part this is attributable to the fact that the weighted XM/M ratio is 21.6% for the 'nonwealthy' U.S. sample versus 18.5% for Canada. However, a higher percentage of Canadian 'nonwealthy' (87.2%) possess XM > 0 than is true of the U.S. 'nonwealthy' (77.1%).

The primary reasons for the higher XM/M ratio in the U.S. sample is first, that a larger share of the U.S. sample is 'wealthy' (40.2% versus 34.1% in Canada) and a higher proportion of U.S. 'wealthy' possess a mortgage (66.7% versus 60.2% in Canada). The latter spread is somewhat surprising because once a Canadian household achieves 'wealthy' status, it does not have to incur such high transactions costs or use junior loans to establish interest deductibility. The major impact of the more liberal interest rate deductions in the U.S. may be on housing demand and the derived M(h). Such an impact would tend to reduce XM/M ratios, although it also should reduce the proportion of U.S. households that are 'wealthy.'

B. Sample Selection, Portfolio Overview and Demand Specification

We approach the estimation of the determinants of XMORT in the same manner as in Chapter III. Thus, we assume households have predetermined the optimal value of their housing investment ($P_H H$) and the amount of mortgage debt required to finance this housing demand

(M(H*)). Excess debt demand (XMORT) is then determined from (3) above. As before, we suppose households choose XMORT under assumptions that permit treating decisions as if households are optimizing over the mean and variance of nonhousing portfolio returns.

Given these assumptions, we estimate

$$(4) \qquad XMORT = \alpha + \beta_1 ASSET + \beta_2 AVERSE + \beta_3 PDEBT + e$$

where these variables are defined to be close comparables to those used in the estimation on Canadian data. Since the United States contains 52 taxing jurisdictions (plus additional local jurisdictions which tax some components of income), it is infeasible to estimate a TXRATE variable comparable to that used in the Canadian analysis. The U.S. data base does, however, contain subjective responses that provide additional information on attitudes toward risk which prove to be useful supplements to the basic attribute data. It also contains additional information which permits better estimates of the determinants of household wealth than was achievable with Canadian data.

The base sample used in the XMORT estimations has 978 observations compared to 1071 in the Table IV-1 computations of XMORT positions. This reduction occurs as a result of restricting the sample to eliminate those who are potentially credit rationed and deleting households with negative net worth or negative positions in any of the aggregate ASSET cohorts utilized. These restrictions are identical to those used in obtaining the Canadian sample and are imposed for the same reasons.

Definition of variables used in the estimations are provided in Table IV-2 and summary statistics for these variables in Table IV-3. The summary statistics are not directly comparable

Table IV-2
Variable Definitions

HOUSE	Market value of principal residence
MORT	Balance outstanding on home mortgage debt
MVMORT	Estimated market value of home mortgage debt
TLA	Total liquid assets: includes checking accounts, money market accounts, savings accounts, IRAs and Keoghs, CDs and savings bonds
LIQ	Min (TLA; .1HOUSE)
NW	Household net worth equals reported net worth + MORT - MVMORT
NHNW	Nonhousing net worth = NW - HOUSE - LIQ if NW ≥ (HOUSE + LIQ); otherwise equals zero
MINMORT	Equals HOUSE + LIQ - NW if (HOUSE + LIQ) > NW; otherwise equals zero
XMORT	Equals MVMORT if NW > (HOUSE + LIQ); otherwise equals MVMORT - MINMORT
MXMORT	Equals zero if XMORT < 0; otherwise equals XMORT
EARN	Total Household labor income
PENSION	Equals '1' if Household head or spouse is covered by a primary pension plan; otherwise equals zero
PENEARN	Equals PENSION * EARN
YRSEMP	Number of years household head has been employed full time.
HEALTH	Self-reported health of household head where 1 = excellent, 2 = good, 3 = fair and 4 = poor

ALIMONY	Amount of alimony, child support or other financial assistance paid by any member of the household to persons outside the household
CHILD	Number of children residing in household
HAGE	Age of the household head
DHAGE	Equals HAGE - 18
MARRIED	Equals '1' if the household head is married; otherwise equals zero
EDPRF	Equals '1' if head or spouse has fifteen or more years of education and a managerial or professional occupation; otherwise equals zero
DSELF	Equals '1' if household head is self-employed; otherwise equals zero
RACE	Equals '1' if the race of the survey respondent is nonhispanic caucasian (as observed by the interviewer); otherwise equals zero
SAVE	Equals '1' if the respondent had positive saving in 1982
WHYSAVE	Equals '1' if the two most important reasons for saving included retirement, investment objectives, to 'get ahead' for the future or because saving is wise, prudent and a good discipline; otherwise equals zero
RISK	Equals '1' if respondent takes 'substantial' risks to earn 'substantial' returns or 'above average' risks to earn 'above average' returns; otherwise equals zero
LIQUID	Equals '1' if respondent is willing to 'tie up money' for a long (intermediate) period of time to earn substantial (above average) returns; otherwise equals zero
BORWBAD	Equals '1' if respondent thinks it is a 'bad idea' for people to buy things on the installment plan; otherwise equals zero
INHERIT	Equals '1' if most of savings comes from gifts, inheritances, settlements, insurance or law suits; otherwise equals zero
EXPINH	Equals '1' if respondent expects to receive a large inheritance; otherwise equals zero

APPREC	Equals ratio of purchase price of current residence to the current market value times 100
REAL (R)	Equals market value of real estate owned, other than the present residence, less the balance owing on mortgage loans other than home mortgage debt; R is a 0,1 dummy that takes the value '1' if REAL > 0
BUS (B)	Equals value of ownership interests in privately held businesses, farms, professional practices and partnerships other than real estate, oil and gas and certain other partnerships. These business interests include the net value of businesses in which respondents had no management interest and the total value of businesses in which they had a management interest; B is a 0,1 dummy that takes on the value '1' if BUS > 0.
TFA	Total financial assets equals TLA plus bonds, stock and mutual fund holdings and trust accounts
FIN (F)	Equals TFA - LIQ; F is a 0,1 dummy that takes the value '1' if FIN > 0
PAPER (P)	Equals cash value of life insurance, loans owed to the household, gas leases, gross value of land contracts and thrift type pension account assets; P is a 0,1 dummy that takes the value '1' if PAPER > 0.
MVEH (M)	Value of all motor vehicles owned by the household; M is a 0,1 dummy that takes the value '1' if MVEH > 0
TA	Gross value of all assets owned by the household
TOMORT	Equals mortgage debt balances secured by properties other than the principal residence
NETA	Equals TA - HOUSE - LIQ - TOMORT
RENA	Equals REAL ÷ NETA
BUSNA	Equals BUS ÷ NETA
REBNA	Equals (REAL + BUS) ÷ NETA
FINNA	Equals FIN ÷ NETA
PAPNA	Equals PAPER ÷ NETA

MVEHNA	Equals MVEH ÷ NETA
PDEBT	Equals total closed end consumer debt outstanding plus credit card debt and debt owed against lines of credit; loans against the cash value of life insurance policies are excluded
AREA1	Equals '1' if the household resides in the central city of a SMSA located in the Northeast; otherwise equals zero
AREA3	Equals '1' if the household resides in the central city of an SMSA in the South; otherwise equals zero.

Table IV-3
Summary Statistics for Variables
Used in Regression Analysis
Number of Observations = 978

HOUSE	70447 (54105)	REAL	15886 (66396)
MORT	18262 (20702)	BUS	40146 (536587)
MVMORT	15215 (18065)	FIN	23803 (165565)
TLA	13859 (28986)	PAPER	9700 (24794)
LIQ	4729 (5645)	MVEH	6732 (5409)
NW	151083 (610274)	TA	176209 (626087)
NHNW	82117 (585201)	NETA	96267 (594666)
MINMORT	6211 (12282)	RENA	.111 (.232)
XMORT	9004 (15423)	BUSNA	.101 (.240)
MXMORT	9542 (14838)	FINNA	.207 (.282)
EARN	34069 (23755)	PAPNA	.178 (.254)
PENEARN	22523 (23969)	MVEHNA	.404 (.362)
PDEBT	5005 (11229)	YRSEMP	21.5 (11.4)
APPREC	475 (258)	ALIMONY	480 (1840)
HEALTH	1.60 (.679)	CHILD	.963 (1.11)
		HAGE	44.3 (11.0)

Notes: Means and standard deviations ( ) are provided.

with those in Table III-3 because the U.S. sample covers all ages and the Canadian sample is limited to young (under age forty) households. When the U.S. sample is restricted to those under age 40 the mean outstanding mortgage balance (MORT) is 26763, mean MVMORT is 22860 and mean XMORT is 11392. Thus, consistent with the findings in Table IV-1, young U.S. households have higher mean XMORT to mean MORT ratios (42.6%) than their Canadian counterparts (31.2%).

In order to keep the number of asset categories tractable, and as comparable as possible to those used in Chapter III, we aggregate nonhousing asset holdings into five cohorts which satisfy the balance sheet identity.

(5) $NETA = REAL + BUS + PAPER + FIN + MVEH$

The cohorts REAL, BUS and MVEH are quite comparable to the variables with the same names in Chapter III. We do not have a separate asset cohort for tax sheltered individual retirement accounts as we did in Chapter III; thus IRA and Keogh accounts are included in FIN (and perhaps in some cases in LIQ). Instead, we have a paper asset (PAPER) cohort which includes an assortment of relatively illiquid and specialized financial assets.

Nonhousing asset portfolios are characterized by incompleteness in the U.S. sample. However, the U.S. sample of young households does hold on the average a somewhat larger number of the five asset cohorts (2.40) than was true (for somewhat different cohorts) in the Canadian case (2.06). For U.S. households of all ages the mean is 2.61.

Table IV-4 provides an overview of the composition of nonhousing asset portfolios for U.S. households of all ages. Once again we find that ownership of real estate (REAL) or

Table IV-4
Household Portfolios for the Sample
Used in Estimating Excess Mortgage Demand

	REAL	BUS	FIN	PAPER	MVEH
Percent Holding the Asset	26.3	20.7	57.1	58.6	98.0
Mean Asset Share (%)	11.1	10.1	20.7	17.8	40.4
Conditional Mean Asset Share (%)	42.2	49.1	36.2	30.3	41.2
Conditional Mean NHNW ($)	225253	290595	130420	110644	76591

Notes: Asset shares are calculated as a percentage of Net Nonhousing Assets (NETA) where NETA = REAL + BUS + FIN + PAPER + MVEH. In the second row shares are computed over the whole sample (N=978), including those cases with zero holdings of the asset in question. In the third row, share calculations are based only on those households holding a positive position in the identified asset. Nonhousing net worth (NHNW) means are also calculated on households holding positive positions in the asset in question; however, zero NHNW positions for these households are included in the mean calculations. The mean NHNW for the whole N=978 sample represented in the Table is $82117.

business (BUS) assets is associated with disproportionately large portfolio shares in these assets. There is also an apparent strong relationship between nonhousing wealth and ownership of REAL or BUS assets.

C. The Reduced Form Results

Tables IV-5, IV-6 and IV-7 provide reduced form estimates of XMORT demand in a form similar to those reported for Canadian data in Tables III-6, III-7 and III-8. The first two sets of regression results are estimated using asset shares as regressors; these include Tobit estimation results in Table IV-5 and OLS results in IV-6. As before, in the Tobit estimations negative XMORT values are treated as having zero XMORT positions, and this dependent variable is labelled MXMORT. These estimates are performed for the sample containing all ages, since there is no reason to restrict the sample to young households, and because the sample size is relatively small if we do so. However, to allow more direct comparisons with the Canadian results we provide U.S. estimates for the 'under 40' cohort below (Section E) for the case where asset tastes are endogenized.

The results reported in Table IV-5 and IV-6 are inconsistent with the diversification hypothesis of excess debt demand. Nonhousing wealth (NHNW) has a positive impact on (M)XMORT demand, rather than the negative relationship predicted by the diversification hypothesis. Again, we interpret the positive wealth effect as a proxy for risk aversion and conclude that risk aversion declines with wealth, although the coefficient suggests the wealth impact is relatively modest. Indeed, column (2) shows that coefficients on other variables are

Table IV-5
Tobit Excess Mortgage Demand
Reduced Form Estimations on Asset Shares
Dependent: MXMORT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NHNW	.004 (1.49)						
RENA			12776 (4.80)				
BUSNA				15964 (6.24)			
FINNA					1265 (0.54)		
PAPNA						8360 (3.44)	
MVEHNA							-19633 (11.0)
EDPRF	8155 (5.87)	8221 (5.91)	7759 (5.65)	8029 (5.95)	8144 (5.83)	8242 (5.96)	6155 (4.78)
CHILD	163 (0.26)	154 (0.25)	316 (0.51)	57 (0.09)	184 (0.29)	112 (0.18)	628 (1.09)
PDEBT	.118 (2.11)	.130 (2.37)	.126 (2.32)	.113 (2.12)	.131 (2.38)	.137 (2.50)	.127 (2.51)
MARRIED	5459 (3.26)	5620 (3.36)	5305 (3.21)	4484 (2.75)	5665 (3.38)	5447 (3.28)	4122 (2.66)
DHAGE	-356 (5.41)	-340 (5.23)	-356 (5.53)	-355 (5.61)	-346 (5.25)	-330 (5.10)	-449 (7.33)
RISK	7628 (4.70)	7735 (4.76)	6637 (4.10)	6655 (4.20)	7730 (4.76)	7845 (4.85)	4942 (3.27)
EXPINH	4751 (2.74)	4963 (2.87)	4837 (2.83)	4019 (2.38)	4885 (2.81)	5190 (3.02)	2937 (1.83)
CONSTANT	4117	3701	3181	4098	3565	2020	16902
Log Likelihood	-7503	-7504	-7493	-7485	-7504	-7498	-7443
$\bar{R}^2$	.138	.136	.160	.187	.137	.147	.279
No. Obs.	978	978	978	978	978	978	978

Note: Asymptotic 't' statistics are in the ( ).

Table IV-6
OLS Excess Mortgage Demand
Reduced Form Estimations on Asset Shares
Dependent: XMORT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
NHNW	.004 (2.17)						
RENA			10492 (5.19)				
BUSNA				14641 (7.59)			
FINNA					1950 (1.13)		
PAPNA						5257 (2.87)	
MVEHNA							-15693 (12.4)
EDPRF	5898 (5.67)	5969 (5.73)	5606 (5.44)	5814 (5.74)	5863 (5.60)	5971 (5.75)	4412 (4.51)
CHILD	-215 (0.46)	-233 (0.50)	-97 (0.21)	-293 (0.65)	-185 (0.40)	-258 (0.56)	219 (0.50)
PDEBT	.066 (1.55)	.078 (1.87)	.075 (1.81)	.063 (1.53)	.080 (1.90)	.082 (1.96)	.077 (1.97)
MARRIED	2991 (2.49)	3173 (2.64)	2924 (2.46)	2194 (1.87)	3247 (2.70)	3095 (2.58)	2113 (1.89)
DHAGE	-123 (2.58)	-107 (2.26)	-118 (2.53)	-123 (2.68)	-117 (2.43)	-101 (2.14)	-205 (4.59)
RISK	6387 (5.23)	6505 (5.32)	5634 (4.63)	5572 (4.67)	6484 (5.31)	6572 (5.40)	4231 (3.68)
EXPINH	4677 (3.57)	4930 (3.77)	4811 (3.73)	4089 (3.21)	4814 (3.67)	5045 (3.87)	3261 (2.67)
CONSTANT	5811	5375	4874	5602	5180	4327	15854
$\bar{R}^2$	.110	.107	.130	.156	.107	.113	.228
No. Obs.	978	978	978	978	978	978	978

Note: Asymptotic 't' statistics are in the ( ).

largely unaffected by the removal of NHNW. However, the wealth effect is supported by the positive and significant coefficient found on the 'expected inheritance' variable.

Using a sample covering a wide span of ages shows that the desire for leverage declines with age; given the positive wealth effect we interpret this result as meaning that risk aversion increases with age. As in the Canadian sample, highly educated professional (managers) are apparently risk takers, and in the U.S. case households headed by married couples have a greater taste for assets that require XMORT financing.

The U.S. SCF also contains respondents subjective evaluation of their willingness to take investment risks (RISK). Although this risk attitude could be regarded as a function of observable household attributes we have not attempted to endogenize RISK. The results in Table IV-5 and IV-6 suggest that the RISK variable adds information on household risk aversion that is not inferable from observed attributes. It contributes significantly to explaining M(XMORT) demand, even controlling for several attribute variables.

The impact of asset 'tastes' on (M)MORT demand appears to be remarkably similar to the findings for young Canadians. Tastes for REAL and BUS assets have strong positive effects on excess debt demands while tastes for consumer durables (proxied by the MVEH share) have a negative effect on XMORT demand. PAPER appear to have the characteristics of illiquid assets like REAL and BUS. Although its coefficient is highly significant the coefficient is smaller than the REAL and BUS share coefficients. The insignificance of FINNA corroborates the conclusion that the diversification motive does not provide an important contribution toward explaining excess demand.

Finally, there is no indication that PDEBT and XMORT are substitutes in the financing of nonhousing assets. Indeed the coefficient on PDEBT is significantly positive in the Tobit estimation. Consequently, it appears that XMORT and PDEBT have separate financing roles.

Table IV-7 reestimates Tobit and OLS results using asset combinations to represent the ASSET vector rather than asset shares. These estimates are similar in form to those in Table III-8. However, since PAPER is a collection of illiquid assets with attributes somewhat similar to REAL and BUS we increase the number of separate combinations identified. The nine combinations utilized in Table IV-7 account for all nonhousing assets; of course, not all nine are used in the same regression. Focusing on the combinations featuring the three illiquid asset classes, the results suggest that (M)XMORT demand is a positive function of the number of these cohorts included in a portfolio and that household taste for BUS has the strongest impact on excess debt demand, followed by REAL and then by PAPER.

Given these results it necessarily follows that at least one of the remaining asset classes (with no illiquid assets present) must be significantly negative. It turns out that both are; moreover, the strong negative impact of household tastes limited to LIQ and MVEH, is consistent with the asset share results reported in Tables IV-5 and IV-6. The results for the other variables in Table IV-7 are also similar to those reported in the previous two tables.

D. Results Based on Endogenizing Asset Tastes

As discussed in Chapter III the reduced form estimates ignore the endogenity of housing wealth and asset tastes. As a result some of the coefficients of interest may be significantly

Table IV-7
Tobit and OLS Excess Mortgage
Demand Reduced Form Estimations on Asset Combinations

	(1)	(2)	(3)	(4)
RBP	19216 (6.31)	15948 (7.05)		
RBNP	13463 (3.68)	10761 (3.90)		
RPNB	13072 (5.80)	9432 (5.61)		
BPNR	15318 (6.01)	12214 (6.42)		
BNRP	12090 (3.91)	9602 (4.12)		
RNBP	9932 (3.83)	8052 (4.20)		
PNRB	6764 (4.25)	4134 (3.57)		
FNRBP			-5827 (2.77)	-3911 (2.57)
MNRBPF			-12357 (6.85)	-8979 (6.99)
NHNW	-.002 (0.70)	-.001 (0.41)	.002 (0.81)	.003 (1.47)
DHAGE	-396 (6.23)	-158 (3.42)	-373 (5.81)	-138 (2.96)
EDPRF	6481 (4.86)	4572 (4.52)	6973 (5.15)	5068 (4.95)
MARRIED	3229 (1.99)	1384 (1.18)	4000 (2.43)	2033 (1.71)
CHILD	421 (0.71)	36.1 (0.08)	400 (0.66)	15.1 (0.03)
RISK	5342 (3.38)	4461 (3.73)	6754 (4.28)	5706 (4.77)
EXPINH	3355 (2.02)	3519 (2.78)	4166 (2.48)	4230 (3.30)
PDEBT	.108 (2.03)	.056 (1.38)	.108 (2.00)	.059 (1.43)
CONSTANT	764	3489	8918	9176
Log Likelihood	-7467		-7478	
R^2	.223		.190	
$\overline{R^2}$		.180		.153
No. Obs.	978	978	978	978

Notes: Columns (1) and (3) are Tobit estimations with MXMORT as the dependent variable. Asymptotic 't' statistics in ( ). Columns (2) and (4) are OLS estimates with XMORT as the dependent variable and 't' statistics in the ( ).

biased. Therefore, in this Section, we proceed to endogenize asset tastes in the same manner used in Chapter III.

First, in Section 1 we provide Probit estimations of household tastes for REAL and BUS assets as a function of measured NHNW and various attributes. The predicted probabilities of the asset combinations being present are then used as regressors in estimating excess mortgage debt demand.

Then, in Section 2 we push the process back a step by estimating a household wealth (net worth) function and use the predicted values to compute estimated NHNW (ESNHNW). We replace NHNW in the probit estimations of asset tastes with ESNHNW, and use the predicted probabilities from these estimates as regressors in estimating excess mortgage demand.

1. First Stage Endogenization of Asset Tastes

The results of Probit estimations on two quite different sets of portfolio tastes are provided in Table IV-8. The first column estimates the likelihood a household will hold at least one of the assets REAL and BUS, and the second column the likelihood a household will not hold REAL, BUS or PAPER. Measured NHNW is highly significant in each regression and its signs are as anticipated.

The results in Table IV-8 suggest that households are more likely to hold REAL or BUS assets if they are headed by a married couple, if the head (or spouse) is a highly educated professional or manager, or if the head is self-employed, and if the household consists of risk takers who are comfortable with borrowing. Households with the opposite signs on the

Table IV-8
Probit Estimation of Tastes for
Real Estate and Business Assets

	REB	NRBP
NHNW	.003 (7.26)	-.022 (7.51)
MARRIED	.321 (2.70)	-.382 (3.43)
CHILD	-.111 (2.62)	
EDPRF	.371 (3.73)	-.302 (2.62)
DSELF	1.39 (8.57)	-.394 (1.91)
RISK	.412 (3.47)	-.125 (0.87)
LIQUID	.054 (0.58)	-.146 (1.44)
BORWBAD	.269 (2.43)	.004 (0.03)
AREA1	-.306 (2.04)	
AREA 3		-.264 (1.31)
CONSTANT	-1.01	0.25
Log Likelihood	-650	-569
McFadden $\overline{R}^2$	.199	.181
No. Obs.	978	978

Notes: NHNW is measured in thousands of dollars. Asymptotic 't' statistics are in ( ).

coefficients of each of these attribute variables are likely to hold portfolios containing no illiquid assets.

The predicted probabilities from these probit estimates are used as regressors in the M(XMORT) estimations reported in Table IV-9. Consistent with the reduced form estimates, excess debt positions are strongly influenced by the presence (absence) of REAL or BUS in household portfolios. Among attribute variables the head's age (DHAGE) and the education/occupation dummy (EDPRF) are highly significant. Also expectations of future wealth windfalls (EXPINH) and positive attitudes toward investment risk taking (RISK) are strong contributors to the explanation of excess mortgage positions.

2. Results When Wealth is Endogenized

In this Section we reestimate the probit asset 'taste' functions using estimated NHNW (ESNHNW) as a regressor in place of measured NHNW. As before ESNHNW is computed from estimating a household total wealth (net worth) function. The results of this wealth estimation are reported in Table IV-10. The number of observations is reduced to 963 due to missing values for one of the regressors (APPREC).

Household labor earnings (EARN) and the self-employment status of the head (DSELF) have strong positive impacts on household wealth accumulation just as they did in the wealth creation of young Canadians (Table III-11). However, the U.S. SCF contains many variables relating to the household's history and attitudes which are significant contributors to explaining current wealth positions. For example, current wealth is strongly positively affected by appreciation in the household's home and the receipt of bequests or other windfalls. Apparently

Table IV-9
Estimated Excess Mortgage Demand Results
Using Endogenized Asset Tastes

	(1)	(2)	(3)	(4)
EREB	16228 (4.96)	14741 (6.07)		
ENRBP			-19442 (4.55)	-20577 (6.62)
DHAGE	-390 (6.00)	-152 (3.24)	-406 (6.17)	-179 (3.77)
EDPRF	6307 (4.47)	4222 (3.97)	5821 (4.02)	3476 (3.20)
CHILD	778 (1.25)	355 (0.76)	388 (0.63)	46.2 (0.10)
MARRIED	3001 (1.74)	826 (0.66)	2216 (1.24)	-368 (0.28)
PDEBT	.103 (1.89)	.055 (1.32)	.128 (2.36)	.078 (1.90)
EXPINH	4300 (2.53)	4282 (3.32)	4206 (2.47)	4108 (3.20)
RISK	4243 (2.45)	3382 (2.59)	5620 (3.40)	4294 (3.46)
CONSTANT	1879	3629	14493	16660
Log Likelihood	-7492		-7494	
R^2	.171		.175	
$\overline{R}^2$		.138		.144
No. Obs.	978	978	978	978

Notes: Columns (1) and (3) are Tobit estimations with MXMORT as the dependent variable and with asymptotic 't' statistics in the ( ). Column (2) and (4) are OLS estimations with XMORT as the dependent variable and 't' statistics in the ( ).

Table IV-10
Estimation of U.S. Household Net Worth
Dependent: LnNW

EARN	.026 (10.3)
EARNSQ	-.001 (4.72)
APPREC	-.084 (8.81)
INHERIT	.287 (3.03)
EXPINH	.191 (3.01)
ALIMONY	.040 (3.08)
YRSEMP	.011 (4.96)
PENEARN	-.002 (1.49)
SAVE	.185 (3.90)
RISK	.215 (3.62)
WHYSAVE	.180 (3.80)
BORWBAD	-.023 (0.40)
DSELF	.599 (7.64)
RACE	.304 (4.05)
HEALTH	-.074 (2.11)
CONSTANT	10.2
$\bar{R}^2$	.439
No. Obs.	963

Notes: EARN, ALIMONY and PENEARN are measured in thousands of dollars and APPREC is divided by 100. EARNSQ = $(EARN)^2$. 't' statistics are in the ( ).

a significant portion of these gains are saved. Positive attitudes toward saving and a willingness to take investment risks also appear to augment household wealth. Although the head's age is not entered it is embodied in YRSEMP, and the length of time the household has owned its home is reflected in APPREC. Caucasians are wealthier, ceteris paribus, than blacks or hispanics.

As before, we call the antilog of the predicted values from the wealth regression, ENW, compute ENHNW = ENW - HOUSE - LIQ and define

$$(6) \qquad ESNHNW = \begin{cases} 0 \text{ if } ENHNW \leq 0 \\ ENHNW \text{ if } ENHNW > 0 \end{cases}$$

Then ESNHNW is used as a regressor in the probit asset 'taste' estimations. The results of this estimation are reported in Table IV-11. Estimated NHNW is significant in each of these estimates and, in each case, has the expected sign. The coefficients and significant levels of the attribute variables are quite similar to the results in Table IV-8.

Finally, the predicted probabilities from the asset taste estimations are used as explanatory variables in the M(XMORT) estimations reported in Table IV-12. The finding that 'tastes' for REAL and BUS assets are key determinants in explaining the demand for excess mortgage debt is corroborated by these results. Except for the head's self-employment, the household sociodemographic, life cycle variables are insignificant and therefore excluded from this estimation. LIQUID and EXPINH are quite significant and the coefficient on PDEBT continues to be positive.

Table IV-11
Probit Estimations of Tastes
for Specific Asset Combinations
Using Endogenized Wealth

	REB	NRBP
ESNHNW	.004 (4.91)	-.005 (3.82)
MARRIED	.422 (3.64)	-.451 (4.06)
CHILD	-.116 (2.88)	.066 (1.59)
EDPRF	.299 (3.19)	-.388 (3.63)
RISK	.480 (4.27)	-.230 (1.73)
LIQUID	.064 (0.72)	-.268 (2.85)
BORWBAD	.242 (2.27)	-.030 (0.26)
CONSTANT	-.920	.060
Log Likelihood	-641	-560
McFadden $\overline{R}^2$	.080	.072
No. Obs.	963	963

Notes: ESNHNW is measured in thousands of dollars. Asymptotic 't' statistics are in ( ).

Table IV-12
Estimated Excess Mortgage Demand Results
Using Asset Tastes Estimated on Endogenized Wealth

	(1)	(2)	(3)	(4)
ESREB	12006 (2.68)	13363 (4.02)		
ESNRBP			-22214 (4.21)	-19739 (5.10)
LIQUID	3262 (2.42)	2254 (2.26)		
DSELF	6492 (3.20)	6049 (3.99)	6061 (3.01)	5929 (3.92)
EXPINH	9026 (5.31)	6637 (5.18)	8627 (5.06)	6386 (4.96)
PDEBT	.121 (2.14)	.062 (1.46)	.124 (2.20)	.071 (1.66)
BORWBAD			-2010 (1.24)	-1216 (1.02)
CONSTANT	-3831	773	8752	12492
Log Likelihood	-7511		-7511	
R^2	.110		.109	
$\overline{R}^2$		.089		.086
No. Obs.	963	963	963	963

Notes: Columns (1) and (3) are Tobit estimations using MXMORT as the dependent variable and with asymptotic 't' statistics in the ( ). Columns (2) and (4) are OLS estimates with XMORT as the dependent variable and 't' statistics in the ( ).

E. Estimates for Young U.S. Households

In this Section we repeat the estimation procedure used in Section D, but here limiting the sample to U.S. households with heads (and spouses) under the age of 40. The purpose of this exercise is to see if the behavior of the young debt demanders is significantly different from that estimate for all ages, and to provide a comparison between U.S. and Canadian results for the same age cohort.

We proceed, first, to estimate the wealth function for the young U.S. household cohort and report the results in Table IV-13. The specification is identical to that used in the estimation for households of all ages (Table IV-10) and the results are very similar. We use these parameters to compute ESNHNW for each observation in the manner described above, and use ESNHNW as a regressor in the estimates of probit asset 'taste' functions. The results from two of these probit estimations are reported in Table IV-14.

For purposes of developing comparative results between the U.S. and Canadian samples we use the two asset combinations of primary interest from the six estimates on ESNHNW reported in Table III-12. Column (1) in Table IV-14 is the U.S. analogue of the column (4) specification in Table III-12. Since illiquid assets are found in three asset cohorts in the U.S. classification, we use cohort FNRBP in column (2) of Table IV-14 as the U.S. analogue to the Canadian FNRB in column (5) of Table III-12.

Estimated nonhousing wealth (ESNHNW) has the expected signs in the two U.S. estimates. Although ESNHNW was insignificant in all the Canadian probit estimates, it is highly significant in the U.S. estimate of the likelihood a household owns REAL or BUS (REB) assets. Positive attitudes toward risk taking (RISK) also increase the likelihood REAL or BUS

Table IV-13
Estimation of Net Worth
for Young U.S. Households
Dependent: LnNW

EARN	.036 (4.23)
EARNSQ	-.000 (1.31)
APPREC	-.110 (6.62)
INHERIT	.311 (2.11)
EXPINH	.252 (2.79)
ALIMONY	.056 (1.73)
YRSEMP	.018 (2.41)
PENEARN	-.004 (1.50)
SAVE	.148 (1.91)
RISK	.274 (2.93)
WHYSAVE	.093 (1.10)
BORWBAD	.078 (0.82)
DSELF	.475 (3.37)
RACE	.427 (3.10)
HEALTH	-.218 (3.17)
CONSTANT	10.1
$\bar{R}^2$	.395
No. Obs.	320

Notes: EARN, ALIMONY and PENEARN are measured in thousands of dollars and APPREC is divided by 100. EARNSQ = $(EARN)^2$. 't' statistics are in the ( ).

Table IV-14
Probit Estimations of Specific
Asset Tastes for Young U.S. Households

	(1) REB	(2) FNRBP
ESNHNW	.011 (3.33)	-.003 (0.77)
MARRIED	.396 (1.84)	-.536 (2.33)
CHILD	-.123 (1.67)	-.043 (0.43)
EDPRF	.234 (1.42)	-.195 (0.88)
BORWBAD	.156 (0.82)	-.188 (0.72)
LIQUID	-.219 (1.38)	.316 (1.57)
RISK	.536 (2.81)	-.324 (1.13)
CONSTANT	-.908	-.763
Log Likelihood	-201	-108
McFadden $\overline{R^2}$	.076	.040
No. Obs.	320	320

Notes: ESNHNW is measured in thousands of dollars. Asymptotic 't' statistics are in the ( ).

assets will be found in the portfolio. It is difficult to find explanatory variables that are significant in explaining FNRB for the young U.S. cohort.

In Table IV-15 we report the results of MXMORT Tobit estimations using the predicted probabilities of these asset combinations as regressors. The U.S. results are shown in columns (1) and (3) and analogous Canadian estimates in columns (2) and (4). In general, asset tastes, at least as measured by these endogenized cohorts, appear to have a larger impact on the excess mortgage demand of Canadian than of U.S. households. It may be that the more liberal interest deduction rules, not only induce relatively larger excess debt demands, but also create a more complex set of asset demands that are financed with excess debt. Thus, while REAL and BUS are the most easily identifiable asset tastes that generate excess debt demand, they provide less complete explanations in the U.S. than they do in Canada.

The other result of particular interest in Table IV-15 is that, contrary to all earlier findings, PDEBT is negative and significant. Thus, for young U.S. households PDEBT and XMORT appear to be significant substitutes. At the time of the 1983 survey, interest on personal debt was also deductible for the purpose of calculating taxable income in the U.S. Since 1986 this deduction has been phased out. Thus, this finding may no longer be valid.

F. Summary and Conclusions

In Chapter IV we have estimated the frequency of positive excess mortgage debt for a sample of U.S. households, the quantitative importance of such debt and the determinants of the demand for excess mortgage debt in the United States. Since U.S. households are able to select home mortgage loans from a much richer menu of options than is available in Canada, we had

Table IV-15
Tobit Estimations of Excess Mortgage Demand on Endogenized Asset Tastes for Young U.S. and Canadian Households

	(1) U.S.	(2) Canadian	(3) U.S.	(4) Canadian
ESREB	13623 (1.99)	24570 (4.61)		
ESFNRB				-33539 (6.52)
ESFNRBP			-23232 (1.43)	
DHAGE		-335 (0.33)		
DHAGESQ		12.8 (0.37)		
PDEBT	-.406 (2.90)	.001 (0.12)	-.369 (2.62)	.000 (0.00)
DSELF	6757 (1.88)		8114 (2.30)	
CHILD		-1790 (2.66)		-1066 (1.70)
TXRATE		359 (3.73)		205 (2.18)
BORWBAD			-1451 (0.55)	
EXPINH	5734 (2.44)		6151 (2.61)	
LIQUID	5190 (2.55)			
CONSTANT	2951	-8621	12029	11798
Log Likelihood	-2931	-6248	-2935	-6238
R^2	.079	.075	.056	.105
No. Obs.	320	771	320	771

Notes: Column (2) is reproduced from column (3) of Table III-13. Column (4) is slightly different from any estimate in Chapter III. The probit estimation that produces the predicted probabilities represented by ESFNRB is reported in column (5) of Table III-12. In all of the Tobit esitmations reported here the dependent variable is MXMORT and asymptotic 't' statistics are in the ( ).

to use interest rate, payments, amortization and term information to estimate appropriate market values of each household's mortgage liabilities.

We found the incidence of positive excess mortgage debt to be about the same in the U.S. and Canada. Nonetheless, excess debt represents a somewhat larger share of total home mortgage borrowings for Americans. However, this difference is not as great as we had anticipated given the more liberal rules regarding the tax deductibility of home mortgage interest in the U.S.

The determinants of excess mortgage demand appear to be remarkably similar in the two countries. In particular, the demand for illiquid assets in the form of investment real estate and business assets appear important in both countries. Similar results were found for household attributes proxying for attitudes toward risk aversion in both countries. Except for young U.S. households, personal debt and excess home mortgage debt appeared to be playing largely segmented asset financing roles.

When household wealth and asset tastes are endogenized for young U.S. households, the impact of illiquid assets appears less important than for the whole U.S. sample or for the Canadian sample. It may be that the more liberal tax rules toward interest deductibility produces more complex behavior especially among a subsample for whom personal debt and excess mortgage debt are close substitutes. However, this result may not survive the change in the U.S. tax law in 1986 which has phased out interest deduction for personal debt.

Finally, the U.S. Survey contains information from the household's past including inherited wealth and other windfalls, price appreciation of the home and labor history. It also includes subjective variables measuring households' subjective attitudes toward liquidity,

investment risk taking, saving and borrowing. These variables prove to provide useful information, beyond what is available in the household attribute variables, that contribute to explaining household debt demand behavior.

CHAPTER V

EVIDENCE FROM HOUSEHOLD ADJUSTMENTS OF HOME MORTGAGE DEBT POSITIONS OVER TIME

From the cross section evidence provided in Chapters III and IV we have reached tentative conclusions with regard to the impact of tastes for specific classes of nonhousing assets upon the demand for excess home mortgage debt. In particular, it appears that tastes for illiquid assets, especially in the form of investment real estate and closely held business assets, are important determinants of excess debt demand. On the other hand, strong tastes for consumer durables appear generally to be negatively associated with the demand for excess mortgage debt. The latter finding suggests that excess mortgage debt and personal debt have essentially segmented financing roles; the one exception to this conclusion is for young U.S. households.

The ultimate test of these findings is whether they prove capable of explaining household adjustment in mortgage debt positions over time. Performance of this test raises difficult estimation problems and suitable data are scarce. In this chapter we offer some preliminary tests based primarily on the panel characteristics of the U.S. Survey of Consumer Finances. In Section A.1 we review the issues and provide an empirical specification.

To perform the estimation we merge data from the 1983 and 1986 U.S. Surveys of Consumer Finance, for households that remained intact and were interviewed in both Surveys. In Section A.2 we review sample selection criteria, and supply variable definitions and summary

statistics for the additional variables created from the 1986 U.S. Survey of Consumer Finances. In Section A.3 results of the empirical estimation are reported and discussed.

For Canadian households the Statistics Canada Survey of Family Expenditures collects a great deal of data on home mortgage adjustments, but these data have not been released on the public use microdata tapes. Moreover, this survey contains no household asset data. We have obtained release of a few of the mortgage debt variables collected in the 1986 Survey, and make use of these added data to provide some estimation of the determinants of mortgage debt adjustments. These estimations are provided in Section B.

A. Mortgage Debt Adjustments by U.S. Households

In the spirit of the model developed in Chapter II, we approach mortgage debt adjustments in the context of households having committed to a housing unit. Thus, any decisions to change home mortgage debt positions take place in the context of optimizing the size and composition of nonhousing portfolios. In Section 1 we establish a framework for the adjustment analysis and provide the empirical specification. The sample characteristics and data are reviewed in Section 2 and the results of mortgage adjustment estimations are reported in Section 3.

1. The Framework and Empirical Specification

Over time, as household wealth, life cycle attributes and portfolio tastes change, and changes in expectations regarding asset returns and risk occur, households will wish to adjust their total nonhousing asset (NHA) holdings and the composition of these portfolios. Given the

balance sheets constraints, in the U.S. case (1) must hold

(1) $\Delta NHA = \Delta REAL + \Delta BUS + \Delta PAPER + \Delta FIN + \Delta MVEH = \Delta NHNW + \Delta XMORT + \Delta DEBT$

where the Δ represents net changes in the values of variables defined above. Using the asset classes employed in the Canadian context, (1) holds when $\Delta PAPER$ is replaced by $\Delta RRSP$.

Our previous, cross-section, results have suggested some linkage exists between specific asset type demands and the form of financing. First, as a general proposition XMORT appears particularly important in financing REAL and BUS assets and PDEBT (and NHNW) in financing consumer durables (MVEH). Since we find little evidence corroborating the diversification motive, increases in debt positions are compatible with increases in NHNW.

Of course, by the variable construction, NHNW is only positive for 'wealthy' households who do not require mortgage debt to finance their home. For the 'wealthy', or for those who become 'wealthy' over the observed time period, NHNW increases (decreases) result from savings (dissavings) and from capital gains (losses) in the NHA portfolio. If there were no liquidity demand (L(h)) associated with housing demand, changes in the market value of the housing unit, other things equal, would have no impact on NHNW. However, given our construction of L(h), increases in house values produce an increased L(h) demand which diverts assets from NHA, and correspondingly results in a decrease in NHNW. However, so long as NHA, and NHNW, remain positive after this adjustment, there are no necessary implications for debt demand, although there may be behavioral responses to the shrinking of the NHA position.

As before we must be sensitive to the existence of typically incomplete markets in

specifying a mortgage adjustment equation to be estimated. In Chapters III and IV we dealt with this problem by using asset class shares of NHA, and portfolio combinations, as a way of avoiding the use of dollar positions on the RHS of the estimating function. Here, the natural extension is to use changes in asset shares on the RHS.

Thus, we estimate a function of the form

(2) $\Delta XMORT = \alpha + \beta_1 (\Delta ASSET) + \beta_2 (AVERSE) + \beta_3 (\Delta PDEBT) + \epsilon$

where the ΔASSET vector consists of the 1986 share of each asset in NHA less its 1983 share. As in the cross-section estimates, only one asset class position is included as a regressor in any equation. Since the subjective variables which served as a proxy for risk aversion (AVERSE) in the 1983 cross-section analysis are not collected in the 1986 Survey, we do not observe changes in these attitudes. Where we do observe meaningful changes in household attributes (eg. in the number of dependent children residing in the household) we do include these in the AVERSE vector.

We retain the maintained hypotheses that households are in NHA and, therefore, debt, equilibrium at each point in time. Therefore, adjustments in debt positions after 1983 are viewed as produced by unforeseen events occurring after 1983. In principle, a full estimation of the adjustment process would repeat the earlier endogenized asset taste estimations for 1986, and regress ΔXMORT on the estimated differences between optimal 1986 and 1983 portfolio positions. This effort is beyond the scope of the present study. Our objective here is to obtain first order evidence on whether mortgage adjustments are triggered by observed changes in asset tastes, conditioned by household attributes, in a manner consistent with the cross-section estimation predictions. Therefore we estimate (2) in its reduced form version.

Finally, we observe that changes occur in the magnitude and composition of NHA portfolios, and in XMORT, for households who are completely passive and make no conscious asset or debt adjustments during the observed period. These changes occur as a result of changes occurring in the market values of assets and debts and from the automatic amortization of debt principal. Such passive behavior may be rational, and consistent with the equilibrium hypothesis, if transactions costs lead households to make adjustments only when NHA positions are moved out of an acceptable 'optimal' band. It primary effect is to produce noise which will make it more difficult to detect true behavioral responses. However, there is also risk of spurious correlations arising in the estimations of (2) as a result of market value shifts.

In our context, this possibility occurs for 'wealthy' households. In general, the declining trend of mortgage rates during the 1983-1986 period produced rising values of MVMORT, except where offset by principal amortization. For the 'wealthy' XMORT = MVMORT; thus ΔXMORT will tend to increase particularly for 'wealthy' households holding large loans, with long periods to term, as of 1983. The changes in mean asset shares reported below (Table V-2), suggests that the primary asset share increase occurred in financial assets.

This finding is consistent with the bull markets in bonds and stocks observed in the mid-1980's. Thus, a spurious positive correlation between ΔFIN and ΔXMORT may be found in estimating (2). Similarly a spurious negative correlation between ΔMVEH and ΔXMORT is of concern. However, the seriousness of these concerns is reduced by our valuation procedure that caps MVMORT at BOOK VALUE.

For the 'nonwealthy' these spurious correlation possibilities do not exist so long as households 'nonwealthy' in 1983 remain 'nonwealthy' in 1986. For these households, NHNW

remains equal to zero and ΔXMORT is unaffected by market value induced changes in MVMORT. The latter is true because XMORT = MVMORT - MINMORT and both components on the RHS are equally affected by a change in MVMORT. For MINMORT, this effect is realized through the effect of MVMORT on NW.

In any case, in order to provide a further test of active behavioral responses producing debt adjustments, we also estimate a probit function of the likelihood that households via refinancing, adding a mortgage where none existed in 1983, or adding a junior mortgage, choose to hold larger (book value) home mortgage balances in 1986 than they did in 1983. About 12.4 percent (Table V-2 below) of households made this adjustment. Alternatively, we calculated what loan balances should be in 1986, based on 1983 mortgage information, if households take no actions other than making the regularly scheduled mortgage payments. We then compute the deviation between observed 1986 balances and the calculated balances and use this deviation as a measure of the LHS mortgage adjustment in estimating an analogue to (2).

2. Sample Selection and Variable Definition

We constructed the panel sample by beginning with the 978 households present in the sample used for most of the estimations performed in Chapter IV. We deleted from this sample, households no longer intact in 1986; these deletions were mostly cases where married couples are no longer living together. Also to focus upon mortgage recontracting behavior, given housing choice, we deleted households no longer owning and residing in the same housing unit they owned and occupied in 1983.

Table V-1
Definitions of Additional Variables

MORT6	Balance Outstanding on Home Mortgage Debt in 1986
HOUSE6	Market Value of Principal Residence in 1986
NW6	Household Net Worth in 1986
TLA6	Total Liquid Assets in 1986
LIQ6	Min (TLA6; .1 HOUSE6)
NHNW6	Equals NW6 - HOUSE6 - LIQ6 if NW6 ≥ (HOUSE6 + LIQ6); otherwise NHNW6 = 0.
MINMORT6	Equals HOUSE6 + LIQ6 - NW6 if (HOUSE6 + LIQ6) > NW; otherwise equals zero
MVMORT6	Estimated Market Value of Home Mortgage Debt
XMORT6	Equals MVMORT6 if NW6 > (HOUSE6 + LIQ6); otherwise equals MVMORT6 - MINMORT6
DNHNW	NHNW6 - NHNW
INCOME5	Total Household Income in 1985
INCOME3	Total Household Income in 1983
DCHILD	Change in the Number of Children Living at Home Since 1983
DFINC	[(INCOME5 - INCOME3) + INCOME3] * 100
HOUSEXP	Expenditures on Home Improvements and Major Housing Durables Since Being Interviewed in 1983. Equals zero if this expenditure is less than $3,000.
DXMORT	XMORT6 - XMORT
DMORT	Equal '1' if MORT6 > MORT; otherwise equals zero

REAL6	Market Value of Real Estate Owned in 1986, other than the Principal Residence
BUS6	Ownership Interests in Privately Held Businesses and Professions in 1986
TFA6	Equals TLA6 plus 1986 holdings of bonds, stock and mutual funds plus trust accounts.
FIN6	TFA6 - LIQ6
PAPER6	Cash value of life insurance, loans owed to the household, gas leases, gross value of land contracts and thrift type pension account assets in 1986
MVEH6	Value of all motor vehicles owned in 1986
NETA6	Equals REAL6 + BUS6 + FIN6 + PAPER6 + MVEH6
REBNA6	Equals (REAL6 + BUS6) ÷ NETA6
FINNA6	Equals FIN6 ÷ NETA6
PAPNA6	Equals PAPER6 ÷ NETA6
MVEHNA6	Equals MVEH6 ÷ NETA6
DREBNA	Equals REBNA6 - REBNA
DFNA	Equals FINNA6 - FINNA
DPNA	Equals PAPNA6 - PAPNA
DMNA	Equals MVEHNA6 - MVEHNA
DRPMT1	Equals '1' if any first mortgage existing in 1983 had less than three years to the end of the term; otherwise equals zero
DRPMT2	Equals '1' if any second mortgage existing in 1983 had less than three years to the end of the term; otherwise equals zero
DPDEBT	Personal Debt Balances in 1986 less those in 1983

In addition, to remain in the sample, households had to have positive net worth and their positions in each asset class had to be nonnegative. Finally, retention in the sample required 1986 observations on all variables needed for the estimation. This included all data required to estimate MVMORT. The MVMORT estimation was performed in the same manner as in Chapter IV for 1983 positions. For 1986, we used 10 percent per annum, compounded monthly, as the going market first mortgage interest rate, and 12 percent as the current second mortgage rate. When these selection criteria were applied, 485 households remained in the panel sample.

Definitions are provided in Table V-1 of variables created from the 1986 SCF, plus additional variables, not previously used, from the 1983 SCF. The same variable names used in the 1983 specifications are employed again; the '6' at the end of the name indicates a variable observed in 1986.

As discussed above, we attempted to ensure that we observe mortgage recontracting conducted in housing equilibrium by restricting the panel sample to households residing in the same home. However, some households did make capital expenditures in housing in the form of additions, alterations or renovations during the inter-survey period. Rather than make the sample still smaller by deleting these households, we retained them and entered these expenditures (HOUSEXP) as an independent variable. We have no way of knowing to what extent these expenditures were capitalized into the reported 1986 market value of homes. However, inclusion of HOUSEXP should help control for debt decisions induced by housing investment rather than changes in NHA objectives.

Finally, some households may be forced to make explicit XMORT decisions as a result of the terms of one or more of their loans being reached during the 1983-86 inter-survey period.

Table V-2
Summary Statistics for Additional Variables

MORT6	18142(21161)	DRPMT1	.043(.204)
MVMORT6	17258(20530)	DRPMT2	.012(.111)
TLA6	21352(42756)	REAL6	20236(65109)
HOUSE6	83426(60520)	BUS6	36387(190399)
LIQ6	6307(6265)	FIN6	27491(81899)
NW6	176578(292237)	PAPER6	15071(41237)
MINMORT6	5693(12489)	MVEH6	9809(7624)
XMORT6	11565(16977)	NETA6	108994(265820)
NHNW6	92539(262101)	REBNA6	.205(.318)
DFNHNW	30873(123970)	FINNA6	.231(.286)
DXMORT	3012(10653)	PAPNA6	.202(.261)
DMORT	.124(.330)	MVEHNA6	.362(.330)
INCOME5	42142(30051)	DREBNA	.007(.229)
INCOME3	36276(28687)	DFNA	.028(.272)
DFINC	22.8(43.9)	DPNA	.002(.213)
HOUSEXP	3344(7311)	DMNA	-.037(.271)
PDEBT	-277(11208)		

Notes: Number of Observations = 485. Means and standard deviations ( ) are provided.

To control for the possibility of systematic differences in the behavioral response of such households, we include dummy variables for first (second) mortgage loans scheduled to reach the end of the term within three years of the 1983 interview.

Summary statistics for these additional variables are provided in Table V-2. At least in nominal dollar terms, on the average this sample realized sizable growth in nonhousing net worth (DNHNW). The mean increase in excess mortgage debt (DXMORT) was relatively modest, and the mean change in PDEBT was actually negative. However, the large standard deviations indicate that a wide range of financing choices were utilized by these households to finance the adjustments in their nonhousing asset (NETA) portfolios.

3. The Empirical Results

The estimation results using DXMORT as the dependent variable are reported in Table V-3. Consistent with earlier cross-section results ΔNHNW (DFNHNW) has a positive, though insignificant sign, contrary to the diversification hypothesis. Similarly, excess mortgage demand is a positive function of income growth, although again the coefficient is insignificant. Unfortunately, the 1986 Survey does not provide personal debt balances to allow construction of a PDEBT variable consistent with that created from the 1983 Survey. Thus, we calculated DPDEBT as the residual from the balance sheet identity (equation (1)). The strong positive coefficient is consistent with the cross-section findings estimated, as here, on all age groups.

The variables XMORT3, RPMT1 and RPMT2 are included to test the concern that spurious correlations might arise from market value changes in passive household portfolios. This concern would be corroborated if XMORT were positive and significant and if the RPMT

Table V-3
OLS Estimations of Determinants of Adjustments in Home Mortgage Debt Positions of U.S. Households
Dependent: DXMORT

	(1)	(2)	(3)	(4)	(5)
DFNHNW	.007(1.30)				
DFINC	10.5(1.02)	10.1(0.96)	12.4(1.14)	12.4(1.15)	9.64(0.91)
XMORT3	-.091(2.66)	-.102(2.89)	-.114(3.14)	-.109(2.97)	-.085(2.36)
HOUSEXP	.121(1.96)	.144(2.22)	.105(1.59)	.103(1.56)	.122(1.89)
DREBNA		9911(4.85)			
DFNA			13.8(0.01)		
DPNA				2162(0.96)	
DMNA					-8539(4.91)
DHAGE	-151(2.79)	-121(2.13)	-138(2.38)	-135(2.32)	-119(2.10)
RACE	-663(0.45)	173(0.11)	96.1(0.06)	96.9(0.62)	-178(0.12)
CHILD3	-117(0.21)	-23.3(0.04)	-28.0(0.05)	-37.3(0.06)	26.0(0.05)
DCHILD3	- 26(0.05)	-210(0.35)	-189(0.31)	-176(0.28)	-265(0.44)
MARRIED	2784(2.38)	3021(2.47)	3240(2.59)	3253(2.60)	2848(2.33)
EDPRF3	2523(2.48)	2908(2.73)	2899(2.65)	2910(2.67)	2646(2.48)
EXPINH3	-272(0.22)	-20.8(0.02)	45.9(0.03)	70.6(0.05)	429(0.33)
PDEBT	.378(8.44)	-20.8(0.02)	45.9(0.03)	70.6(0.05)	429(0.33)

	(1)	(2)	(3)	(4)	(5)
WINDF3	.010(0.21)	.010(0.21)	-.000(.001)	.001(0.27)	-.021(0.43)
RPMT1	-2030(0.93)	-2926(127)	-2218(0.94)	-2043(0.87)	-1973(0.86)
RPMT2	-3007(0.74)	-972(0.23)	-1755(0.40)	-1618(0.37)	-1444(0.34)
CREDIT3	755(0.84)	1007(1.08)	1212(1.27)	1293(1.35)	1366(1.47)
RISK3	1279(1.07)	1300(1.04)	1655(1.29)	1663(1.30)	1680(1.35)
LIQUID3	-541(1.78)	-232(0.74)	-175(0.54)	-188(0.58)	-258(0.82)
REJECT3	3804(2.41)	4602(2.78)	4427(2.61)	4446(2.63)	4715(2.85)
CONSTANT	5471	2689	2985	2820	2518
$\bar{R}^2$	.181	.103	.058	.059	.104

Notes: Number of Observations = 485. A '3' at the end of the variable name indicates that the values of this variable are observed in 1983. 't' statistics are in ( ).

variables were significant with either sign. Since none of these results occur, these concerns are alleviated. The significant negative sign on XMORT3 is consistent with the proposition that households initially holding a large debt position are more likely to reduce, rather than increase, their market value of their mortgage debt.

The subjective components of AVERSE do not contribute much explanatory power. However, household attributes DHAGE, MARRIED and EDPRF are consistently significant. The significance of REJECT3 suggests that deficiencies that lead to a household being rejected for credit are often not permanent. Thus, when the opportunity to borrow arises, previously rejected households take advantage of the opening.

Because we know that nonhousing wealth accrual has a systematic effect on asset tastes, and because it appears that PDEBT and XMORT demand have some common underpinnings, we delete these variables as regressors when the changing asset share variables are added as regressors. The coefficients on the asset share variables are consistent with the earlier findings, and thus reassuring. They suggest that excess mortgage debt demand derives particularly from decisions to increase the illiquid asset share (REAL + BUS) of NETA, and excess mortgage demand is negatively associated with increases in the consumer durables (DMNA) share. The insignificance of DFNA is reassuring; it provides further evidence that there is no significant spurious correlation present. This finding, together with the large 't' statistic on DMNA support the conclusion that mortgage debt does not play a significant role in financing consumer durables.

Table V-4 reports results of the probit estimation of DMORT. Controlling for capital expenditures on housing, only DFINC, CHILD and REJECT are consistently significant by the

Table V-4
Probit Estimation of the Likelihood
that U.S. Households Increased Their Home Mortgage Loan Balances
Dependent: DMORT

	(1)	(2)	(3)	(4)	(5)
DFNHW	-.001(0.90)				
DFINC	.005(2.84)	.004(2.65)	.004(2.80)	.004(2.71)	.004(2.78)
XMORT3	.008(1.45)	.007(1.20)	.007(1.15)	.005(0.92)	.005(0.91)
HOUSEXP	.021(2.38)	.022(2.57)	.021(2.38)	.021(2.37)	.020(2.26)
DREBNA		.528(1.60)			
DFNA			-.509(1.70)		
DPNA				-.272(0.72)	
DMNA					
DHAGE	-.008(0.75)	-.005(0.53)	-.006(0.62)	-.007(0.71)	-.008(0.74)
RACE	-.222(0.90)	-.199(0.81)	-.200(0.82)	-.203(0.83)	-.202(0.83)
DCHILD	-.111(1.14)	-.116(1.20)	-.104(1.08)	-.111(1.16)	-.106(1.10)
CHILD	.169(1.85)	.175(1.91)	.166(1.83)	.169(1.85)	.165(1.81)
MARRIED	-.075(0.35)	-.074(0.35)	-.34(0.16)	-.064(0.30)	-.044(0.21)
EPPRF3	.003(0.17)	.036(0.20)	.054(0.30)	.047(0.27)	.057(0.32)
EXPINH3	-.190(0.83)	-.185(0.81)	-.212(0.93)	-.196(0.86)	-.209(0.91)

DPDEBT	.019(2.53)				
WINDF3	-.029(1.16)	-.026(1.25)	-.025(1.17)	-.026(1.22)	-.025(1.17)
RPMT1	.322(0.85)	.253(0.66)	.280(0.73)	.294(0.78)	.307(0.82)
RPMT2	-.051(0.08)	.074(0.11)	.073(0.11)	.014(0.02)	.015(0.02)
CREDIT3	.105(0.65)	.075(0.48)	.096(0.61)	.086(0.54)	.096(0.61)
RISK3	.057(0.28)	.044(0.22)	.041(0.20)	.069(0.34)	.067(0.33)
LIQUID3	-.053(1.02)	-.051(1.08)	-.048(1.02)	-.040(0.84)	-.039(0.80)
REJECT3	.483(1.95)	.504(2.04)	.505(2.06)	.509(2.08)	.507(2.09)
CONSTANT	-1.11	-1.20	-1.20	-1.16	-1.16
LOG LIKELIHOOD	-182	-182	-182	-182	-182
McFadden $\overline{R}^2$	.072	.059	.060	.053	.054

Notes: Number of Observations = 485. The variables WINDF, DFNHNW, XMORT3 and HOUSEXP are scaled in thousands of dollars. A '3' at the end of a variable name indicates the values are observed in 1983. Asymptotic 't' statistics are in ( ).

usual standards and the explanatory value of the equations is low. However, each estimated equation has a prediction success rate in excess of 87 percent.

The coefficients on the changes in asset shares are not significant by the usual standards. However, the DREBNA and DFNA results do provide some support of the cross-section results. On the other hand, the coefficient on DMNA is not negative and significant as expected.

As noted above, we also estimated deviations between observed outstanding home mortgage balances in 1986 and our estimation of what these balances would have been without additional borrowing or principal paydowns beyond scheduled amortization. These deviations were used as the dependent variables in an otherwise similar OLS estimation. There is, however, a lot of noise in the deviation because we did not know for each household the elapsed time between interviews; we simply assumed a three year interim in all balance calculations.

Perhaps because of the noise this uncertainty created, the explanatory value of this set of estimations was even lower than those in Tables V-3 and V-4. However, the DREBNA coefficient is nonetheless positive and significant at the five percent level. The other asset share variables have insignificant coefficients. Since no further findings are apparent we do not report the full estimation results.

B. Mortgage Adjustment by Canadian Households

The most promising data on mortgage debt adjustments collected in Canada are found in Statistics Canada's Family Expenditure Survey (FAMEX). In order to focus on a time period similar to that used in analyzing U.S. mortgage adjustments we make use of the 1986 FAMEX Survey. The FAMEX Survey collects an unusually rich mix of data on all home mortgage loans

held by interviewed spending units. These data include for each loan, mortgage payments actually made each month during 1986, contract interest rates, the beginning and end dates of the term, the original principal amount, the type of lender and whether the loan has a variable (adjustable) rate. Also the Survey interviewer records any additional amount borrowed on existing mortgage loans during the year and any lump sum payments made during the year. The Survey also provides the purchase and selling prices of homes bought or sold during the year.

These data provide an analyst with the ability to fully reconstruct each spending unit's mortgage adjustments during the year. In particular, these data constitute the most valuable information base available for estimating prepayment models. Prepayments are the principal risk facing investors in mortgage backed securities as well as mortgage lenders who retain loans they originate. Loans and securities cannot be efficiently priced without empirically proven prepayment models; the lack of credible models in Canada has had the effect of impeding development of the MBS market and adds unnecessarily to the cost of mortgage debt. Uniquely and importantly these data would allow one to distinguish pure refinancing rollovers of the existing balance, from rollovers in which the mortgagor adjusts the amount borrowed. They provide the basis for understanding the determinants of positive and negative debt adjustments.

Unfortunately, this promise has not been fulfilled for two reasons. First, the value of these data is diluted because they are collected in the FAMEX Survey rather than with the Assets and Debt Survey component of the SCF. As this monograph has emphasized, understanding the demand for home mortgage debt, in general, and adjustments to these debt positions, in particular, requires explaining the impact of tastes for nonhousing assets on debt demand. No asset data are collected in the FAMEX Surveys.

Second, and particularly distressing, none of this valuable information has been included in the public use micro data tapes produced from the FAMEX data. This author approached Statistics Canada in 1989, prior to preparing the proposal for the CMHC grant which subsequently funded this study. A request was made to release all data pertinent to the mortgage adjustment portion of the study. The final result of the ensuing negotiations was Statistics Canada's preparation of an augmented 1986 FAMEX tape which included only six of the 25 items requested. This tape was provided to the author in April 1991.

The additional information provided includes the beginning and ending dates of the term on the largest loan outstanding at year end, the termination date of the amortization period on the largest loan and whether the spending unit has more than one mortgage loan. The total home mortgage balance for all loans and the net change in principal outstanding during the year is also available on the public use tape. However, the critically important information on mortgage payments, and on specific decision to increase borrowing, were not released.

We attempt to find what insights on mortgage adjustments can be learned from these, disappointingly limited, data resources by focusing on explaining the net change in total mortgage loan balances, (NMORT) realized during the year 1986. As before, we restrict the sample to spending units which constitute households and restrict household selection to those remaining in the same owner-occupied residence throughout the year.

We are able to use several types of explanatory variables. First, a wide range of household socio-demographic attributes were included as potential measures of risk aversion. Second, some households may perceive debt reduction to be the optimal use of savings. Although, household net worth is not provided in the Survey, so nonhousing net worth is not

calculable, the net change in assets and liabilities during the year (NNW) is provided. Of course, this change on net worth variable may also proxy the level of net worth. Wage and salary income (WAGE) also serves as a measure of a household's ability to reduce debt balances, or its ability to carry a larger debt burden. Total consumption expenditures (CONSP) is included as an explanatory variable and interpreted as a proxy for permanent wealth.

We are not able to calculate the change in XMORT during the year. Therefore, as above we include capital expenditures on home additions and renovation (RENOV) as a regressor to control for the portion of debt demand adjustment derived from housing demand. The only measure of the magnitude of nonhousing assets in the household portfolio is total investment income (INV). From our previous findings INV may serve as a very crude proxy for household tastes for illiquid assets such as investment real estate or business assets.

Finally, the magnitude of mortgage balance adjustments is affected by the length of time remaining in the amortization period. Loans due to be fully amortized in a relatively few years will experience relatively large principal paydowns. Therefore, we include dummy variables (EAM) to control for this effect. We also include a dummy for loans which are due to reach the end of the term within a year.

Full variable definitions are provided in Table V-5 and the NMORT estimations in Table V-6. Surprisingly, age of the head has a strong positive impact on debt adjustments. On the other hand, Asian immigrants are more likely to disproportionately reduce mortgage balances. The strong negative coefficient on NNW is tentatively interpreted as an indication that debt reduction is a high priority when wealth enhancement is realized. However, the sign on WAGE and CONSP change when the sample is limited to households holding positive mortgage debt

Table V-5
Variable Definitions for Estimations
on 1986 Family Expenditure Data

NMORT	Net Change in Mortgage Debt Liabilities During 1986
NNW	Net Change in Assets Less Net Change in Liabilities During 1986
INV	Income From Investments Including Interest, Dividends, Net Rents and Trust and Estate Income
WAGE	Income From Wages and Salaries
CONSP	Total Consumption Expenditures
RENOV	Expenditures on Additions, Renovations and Alterations to Home and Expenditures on Newly Installed Fixtures and Equipment in the Home
HAGE1	Equals '1' if Household Head is 35 to 50 years of Age; otherwise equals zero
HAGE2	Equals '1' if Household Head is 51 to 65 Years of Age; otherwise equals zero
HAGE3	Equals '1' if Household Head is over 65; otherwise equals zero
DSELF	Equals '1' if Household Income includes Positive Income From One or More Members Self Employment; otherwise equals zero
IMGBTH1	Equals '1' if Head or Spouse Immigrated to Canada Since 1975 and the Immigrant was born in Asia; otherwise equals zero
IMGBTH2	Equals '1' if Head or Spouse Immigrated to Canada Prior to 1976 and the Immigrant was Born in Asia; otherwise equals zero
ETERM	Equals '1' if the Term on the Largest Home Mortgage Loan is in 1987; otherwise equals zero
EAM1	Equals '1' if the Largest Loan has an Amortization Period Ending Prior to 1989; otherwise equals zero

EAM2	Equals '1' if the Largest Loan has an Amortization Period 1989 - 1993.

Table V-6
OLS Estimation of Canadian Household Adjustments in Home Mortgage Balances During 1986
Dependent: NMORT

	(1)	(2)
NNW	-.044(9.41)	-.182(12.0)
INV	.014(2.12)	.098(3.66)
CONSP	.014(2.41)	-.035(2.63)
WAGE	-.013(3.64)	.009(1.11)
RENOV	.325(15.8)	.498(15.9)
HAGE1	473(2.57)	590(2.17)
HAGE2	799(4.02)	1024(2.86)
HAGE3	795(3.38)	1358(2.07)
DSELF	-323(1.78)	- 141(0.43)
IMGBTH1	-1408(2.53)	-1475(1.86)
IMGBTH2	-1605(4.27)	-1404(2.33)
ETERM	246(1.57)	382(1.62)
EAM1	-2089(6.64)	-1966(4.73)
EAM2	- 987(4.64)	- 900(3.22)
CONSTANT	-1315	- 852
$\bar{R}^2$	.084	.151
No. Obs.	5449	2560

Notes: The estimation in column (1) includes all eligible cases including those with zero MORT positions at year-end; column (2) is restricted to cases with positive home mortgage positions at year-end. 't' statistics are in ( ).

positions.

The greatest explanatory value is provided by RENOV, suggesting that mortgage adjustments derive importantly from changes in housing demand. However, the importance of this effect, and of the head's age and other variables, cannot really be assured absent data on adjustments in nonhousing asset portfolios. The positive significance of INV suggests that nonhousing asset portfolios do affect the demand for mortgage debt at the margin.

C. Summary and Conclusions

In this chapter we attempt to test findings generated from the cross-section analysis of excess mortgage debt demand. We do so by focusing upon explaining household adjustment in mortgage debt positions over time. There are two sources of data potentially suitable for this task. The first comes from merging the 1983 and 1986 U.S. SCF tapes to create a file for intact households interviewed in both surveys. The second potential source is the Statistics Canada 1986 Family Expenditures Survey micro data tape. A large amount of mortgage data were collected in this survey, enough to allow a complete reconstruction of each loan principal adjustment made by each spending unit sampled during the full calendar year 1986.

The behaviour of U.S. households is examined both in terms of net changes in excess debt positions over the three year period, and in terms of estimating a likelihood function of the probability that a household takes action to increase its mortgage borrowing outstanding. Both results provide general support for findings obtained from the cross-section analysis. In particular, at the margin excess mortgage debt demand does appear to derive, in a significant way, from the demand for investment real estate and business assets.

Our ability to test the Canadian cross-section findings was frustrated by Statistics Canada's unwillingness to release the required mortgage data for this study, and by the fact that the FAMEX survey does not collect household balance sheet data beyond the mortgage balance and the value of a owner-occupied home. Therefore, findings with regard to the effect of household attributes, wealth, nonhousing investments and changes in housing demand upon mortgage adjustments by Canadian households are treated as very tentative.

CHAPTER VI

IMPLICATIONS OF THE STUDY FOR POLICY ISSUES OF RELEVANCE TO CMHC

This study has approached the demand for home mortgage debt by separating this demand into two components. The separation is based upon the nature of the assets financed by mortgage debt secured by principal residences. In part, mortgage demand derives from housing demand but it may also derive from the demand for nonhousing assets or consumption.

We develop a certainty model to accomplish the separation of mortgage debt into its housing and nonhousing financing roles. In the process, we identify a set of assumptions which ensure that the minimum amount of mortgage debt required to acquire the optimal house is also the optimal quantity of debt. However, in a world with uncertain returns to housing and nonhousing assets, significant transactions and asset holding costs, and nonneutral taxes, optimal debt positions may differ from the (minimum) debt derived from the demand for housing.

For example, further levering of one's home may be justified as a means of acquiring financial assets to diversify away the unsystematic risk associated with a portfolio dominated by a single lumpy, risky, illiquid asset (owner occupied housing.) Alternatively, borrowing on one's home may be justified to acquire investments with tax shelter attributes or assets that are complementary to human capital skills employed, for example, in a profession or closely held business or in real estate property management. The amount of debt used for these purposes should be affected by the household's risk aversion, it's after tax cost of mortgage debt and the

perceived substitutability of mortgage debt and personal debt.

The study's empirical results indicate that, contrary to previous belief, the diversification motive plays a secondary role, at best, in explaining debt demand. Most important appears to be household tastes for business and real estate assets. Most household attributes, which serve as proxies for risk aversion, do not significantly contribute toward explaining the demand for debt in excess of that required to finance the principal residence. However, in the U.S. data base, subjective information on attitudes toward risk, savings and liquidity, as well as expectations of future wealth windfalls, do contribute more explanatory value than is obtainable from observable attributes. Particularly significant in the Canadian results is evidence that debt demand is positively impacted by a household's marginal income tax rate, which we interpret as reflecting the household specific after tax cost of mortgage debt.

In the remainder of this chapter we discuss the implications of these findings for first, public policy questions of interest to, or affected by, CMHC and second, characteristics of data bases required to understand the demand for mortgage debt and its relationship to the demand for housing.

A. Implications for Policy

The study's results have direct implications for the conventional belief that government programs to reduce mortgage costs are an effective means of increasing the effective demand for housing. Programs in question include public mortgage insurance, mortgage rate insurance, mortgage backed security guarantees and direct interest subsidies that have been offered in various forms over time by federal and provincial governments.

Underlying these programs is the assumption that mortgage demand and housing demand are tightly linked, so that very little, if any, of induced increases in mortgage demand leak into financing nonhousing consumption or assets. In Canada, this belief is reinforced by the fact that interest on mortgage debt used to acquire, retain, or make capital improvements in, a home is not deductible in computing taxable income.

However, our results do not corroborate this key assumption. Indeed, we estimate that about one-third of home mortgage debt exists to finance nonhousing assets. At the margin, the proportion of an additional dollar of mortgage loan demand that finance, nonhousing investments is likely significantly greater than one-third. Moreover, our findings suggest that the assets so financed tend not to be marketable financial assets, but quite illiquid and risky business and real estate assets. In some cases the returns from these assets are likely to be highly correlated with household income generated from human capital. In these situations, principal residence, are levered to acquire highly risky and undiversified asset portfolios.

Moreover, the absence of interest deductibility does not greatly inhibit home mortgage financing of nonhousing assets. Interest on home mortgage debt used to finance nonhousing assets has always been deductible for tax purposes, contrary to common assertions. However, there was reason to believe that households would have to engage in frequent refinancing and use of junior mortgages to establish the linkage between mortgage borrowing and eligible investments. It is really the transactions and interest costs of these activities that could credibly be regarded as barriers to home mortgage financing of nonhousing assets. To test this proposition, we compared our Canadian results with the results of a similar analysis on U.S. households. We find that although it is true that U.S. households have more excess mortgage

debt as a proportion of total home mortgage debt, than is true for Canadians, the differences are not very large. Moreover, the uses of this excess debt are quite similar in the U.S. and Canada.

An example of a policy decision which appears questionable when viewed in the light of these results is CMHC's recent proposal to increase the allowable loan-to-value ratio on insured loans to 95 percent. Implementing this policy change would seem imprudent in view of the low rate of household formation, and housing demand, forecast for the decade of the 1990's. Most housing economists believe that the effect of the 'baby bust' generation on household formation will be soft housing markets with significant declines of real (and even nominal) house prices in some markets. This phenomenon by itself puts the Mortgage Insurance Fund at considerable risk. However, our results also suggest that softening house prices are also likely to result in an increase in the use of home mortgage debt to finance risky nonhousing assets. Unfortunately, the Canadian Survey of Consumer Finances does not distinguish CMHC insured loans from privately insured or uninsured loans. Therefore, we do have no way of knowing whether larger (smaller) proportions of CMHC insured financing are used to support risky nonhousing assets.

B. CMHC Concerns and Canadian Data Quality

This study has reinforces our 1984 CMHC financed study's conclusion that micro household balance sheet data are critical to understanding household tenure choice, housing demand and mortgage demand behavior. We reach this conclusion in this study after working intensively with Statistics Canada's 1984 Survey of Consumer Finances and 1986 Survey of Family Expenditures and the U.S. Federal Reserve Board's 1983 and 1986 Survey of Consumer Finances. Our work suggests several issues of data quality should be of concern to CMHC in

fulfilling its mandate to understand housing and mortgage markets as fully as possible.

First, the key importance of balance sheet information derives, in this study, from the finding that, as reviewed in Section A, a sizable portion of home mortgage debt is used to finance nonhousing assets. On the other hand, the evidence suggests that mortgage debt does not play a significant role in financing nonhousing consumption. Thus, the balance sheet orientation of the Survey of Consumer Finances is of considerably more value than the expenditure focus of the FAMEX surveys. This conclusion mirrors our earlier (Jones, 1989) conclusion that housing demand is best understood in its asset demand, rather than in its housing service expenditure, formulation. The investment component of housing demand has been increasing emphasized in the literature of the past decade.

However, the FAMEX Survey does collect information on mortgage debt positions which would be more valuable if (1) they were released on the public microdata tape and (2) they were collected in the SCF. These data include information on the data of mortgage origination, and its term, interest ratio, payments and type of loan. The FAMEX Survey also contains information on increases in mortgage debt, the stated purpose of additional debt and amounts of principal paydown which are valuable in estimating what drives adjustments in mortgage debt. Using these data to estimate the determinants of prepayments would be valuable for developing effective pricing models for Mortgage Backed Securities.

Unfortunately, Statistics Canada has jealously guarded these data and not released the collected information on its FAMEX public use tapes. I approached Statistics Canada with a request to release 25 pieces of mortgage information from the 1986 FAMEX tape. After extended negotiation, data on only six variables were released, not enough to make much use

of the FAMEX tape in this study.

Thus, understanding of housing and mortgage demand in Canada has to rely on the infrequent occasions when the Survey of Consumer Finances includes balance sheet information in its collection. This has occurred on a seven year cycle, in 1970, 1977 and 1984. However, Statistics Canada did not perform its 'Assets and Debt' survey in 1991 and, according to those close to the SCF, has no plans to do so. Continuing and improving this Survey should be a high priority concern for CMHC.

Using the U.S. Survey of Consumer Finances, which collects similar asset and debt data, has allowed us to identify several areas where important improvements could be achieved in the Canadian SCF. First, the Federal Reserve Board has recognized the critical importance of household balance sheet information to analyze housing and mortgage market issues. This recognition produced an expanded SCF in 1983 and repeated surveys in 1986 and 1989. Second, mortgage data is collected in sufficient detail to allow, as we have done in this study, credible estimates of the market value of mortgage debt to be made. As Canadian loans are being originated with longer terms, this has become a critical issue in the Canadian context. Third, the U.S. Survey identifies whether a loan is insured or guaranteed by specific government agencies. As noted above, the Canadian SCF does not contain this information. Consequently, for example, it is not possible to explore the extent to which CMHC is exposed to substantial portions of insured home loans being used to finance risky nonhousing assets. Thus, addition of a variable that distinguishes both the type of lender and insurer would be of assistance to CMHC's evaluation of underwriting risk.

Fourth, the U.S. SCF collects a great deal of attitudinal and expectational data from

households surveyed. We have shown in this study how these data provide significant behavioral evidence beyond what can be inferred from the usual economic and life cycle household attribute information. Finally, the U.S. SCF is designed to reinterview households previously interviewed. All evidence produced from cross section data are tentative until they can be confirmed with estimations based on household debt (housing) adjustments over time. This confirmation is unavailable in Canada due to the absence of any panel data. We have shown in this study how panel data can be used to test conclusions from cross section estimates by using the U.S. SCF.

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